COMPTON'S PICTURED ENCYCLOPEDIA

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Hilda Hanway

Optimism

THE HOPE of the earth is the optimist looking forward and believing all is well. There are pessimists everywhere, despairing of humanity, believing in the doom of all things; but the faith that is based on reason refuses to be mocked and told that life is an empty dream.

"The mind that understands the past will shrink from no vision of the future that imagination can conceive. A few thousand years have opened up the entire field of human knowledge; a few hundred years have 'made us masters where we were slaves'. What, then, is impossible in millions of years?

"The mysterious power of man, the mighty processes of chemistry, the strange promptings of the soul, the throbbing in ethereal space—who shall set a limit to illimitable things like these?" (*See page 2586*)

OPTIMISM

COMPTON'S PICTURED ENCYCLOPEDIA

VOLUME 5

To inspire ambition, to stimulate the imagination, to provide the inquiring mind with accurate information told in an interesting style, and thus lead into broader fields of knowledge—such is the purpose of this work

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HERE AND THERE in Volume Five

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. Divided as it is into broad groups, it offers a fascinating variety of subjects for selection. With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list contains, however, only a small proportion of the articles in this one volume, and is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Study Outlines in Volume Eight.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index in the last volume. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, swạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, nŏt, fôr, wȯn, dọ; cūre, bŭt, düne* (French *u*), *rụde, fụll, bûrn; ḡo, ġem, cañyon, Jeaṅ,* (nasal); G = German *g* (guttural); K = German *ch* (guttural).

MARCH. Before January and February were introduced into the calendar the Roman year had only ten months, and March, named in honor of the god Mars, was the first instead of the third month. In the Middle Ages the year was usually reckoned as beginning on March 25, and England did not abandon this practice until 1752. The last three days of March were once supposed to have been borrowed from April, and according to an old proverb they are always stormy. The vernal equinox (*see* Equinox and Solstice) falls on March 21, so the month is part winter and part spring. According to the old saying, if it "comes in like a lion it will go out like a lamb."

MARCH, GEN. PEYTON CONWAY (1864–). Whenever the officers of the general staff assembled at Washington to map out the plans which helped to bring victory in the World War of 1914–18, a slim bearded man was seated at the head of the long table. This was Gen. Peyton C. March, chief of staff of the United States army, a position to which he was promoted after meritorious service as chief of artillery under General Pershing in France during the first months of the American participation in the war.

After graduating from Lafayette College in Pennsylvania, March became an honor graduate of West Point in 1888. At the end of ten years of service he was in command of the famous Astor Battery in the Philippine Islands during the Spanish American War. During the next three years he held various military and civil positions of importance in the islands. In the Russo-Japanese War he was an official observer with the Japanese army for the United States. He served as a member of the General Staff, 1903–07, and attained the rank of colonel in 1916. When the United States entered the World War in 1917 he was on duty on the Mexican border, and was promoted to brigadier-general, and shortly afterward major-general of the United States army (Sept. 1917). "Aggressiveness, initiative, and organizing power" are the qualities which brought General March his success, both in his earlier positions, and in the more important ones which the World War opened to him. Several universities have honored him with the degree LL.D. and Congress in May 1918 raised him to the rank of general. He was retired from active duty at his own request in 1921.

The MAN *who* FIRST MASTERED "WIRELESS"

How the Unseen Waves of Electricity were Harnessed — The First Radio Message across the Atlantic—Saving Ships at Sea

MARCO'NI, GUGLIELMO (1874–). In 1902 the first wireless telegram was sent across the Atlantic Ocean. That achievement crowned with success Guglielmo (or William) Marconi's years of patient labor, and put him in the ranks of the world's great inventors. Other men had worked out the basic scientific principles on which wireless telegraphy rests. It was the work of this young Italian-Irish engineer to solve the practical difficulties, invent new apparatus and make wireless telegraphy a working achievement.

Marconi was born near Bologna, Italy, of an Italian father and an Irish mother. He was educated in both Italian and English schools. The Italian universities gave him his training in scientific subjects, and Rugby gave him an English manner and speech.

One of his professors at Bologna had made some very important experiments with the electric "Hertzian waves," now used in all wireless telegraphy. Marconi learned all that this professor could teach him and went on to make further investigations for himself. In 1896, after two years of careful work, the young man produced the first workable apparatus for electric wave telegraphy. He soon improved it so that he could send messages for several miles.

Marconi believed that his invention had boundless commercial possibilities and tried to interest the Italian government. Failing to get support he went to England and conducted demonstrations there. The chief of the government postal-telegraph system had been working with wireless himself, but he was most generous in aiding his rival. The public, however, scoffed at the idea of telegraphing without wires.

In 1897 he organized a company for sending messages short distances between ships, and between ships and shore. Meanwhile he kept ceaselessly at work, trying to improve his apparatus so that he could telegraph across the Atlantic. The difficulty was, as he himself said, that "it is not a case of one machine here (in Nova Scotia), and one in England, but of *half* a machine here and another half in England, and each of the machines must be adjusted, the one to the other." Not only must he attain the most delicate adjustment in parts widely separated, but he had to construct powerful and expensive dynamos, so that the electric waves might be strong enough to pass from the Poldhu Station in Cornwall to Cape Breton in Nova Scotia, a distance of about 2,000 miles. It took Marconi five years to achieve this

result and send and receive a trans-Atlantic message.

Marconi put his wireless telegraphy to practical use early in its history. In 1898 it was used to report a boat-race. The same year it was installed in the yacht of the Prince of Wales, who was then ill, so that Queen Victoria might receive a daily bulletin of his condition. Very early also his company undertook to transmit commercial messages for private persons, thus arousing the bitter opposition of the old cable companies.

In 1904 Marconi established a service to furnish news to ships all over the world. Today ships thousands of miles out at sea receive bulletins of what is happening on shore almost as soon as it occurs, and passengers may receive and send messages from and to any part of the civilized world.

The first striking practical service of wireless was in 1909, when the passengers of the sinking steamship *Republic* were rescued by ships summoned by the wireless operator, Jack Binns, who fearlessly stuck to his post. Most governments have since passed laws requiring the installation of wireless apparatus on all passenger vessels.

During the World War Marconi's invention was of incalculable military and naval service to both sides. It was used for directing naval movements, for communications between aircraft in the air and with their bases, and for directing artillery fire when telephones were impracticable.

Marconi himself served throughout the war as director of Italy's wireless system. He has been made a member of the Italian Senate and he received the Nobel prize for the greatest discovery in physics, in 1909. (*See* Wireless Telegraph and Telephone.)

THE MAN WHO MADE THE "S. O. S." POSSIBLE

A great ship is sinking far out at sea. Passengers and crew — hundreds of human beings — are facing sure death in the raging waves. A man dashes to a small metal key, presses it quickly, and out into space, as fast as light, flashes the "S. O. S." — the signal of distress. Giant liners, greyhounds of the ocean, catch the signal and halt their headlong course. Around they turn and forge full steam to the rescue. The victims of the sea are saved, each one owing his life to the man who made wireless telegraphy possible — Guglielmo Marconi.

Marcus Aurelius Antoninus, Roman Emperor (121–180 A.D.). In the midst of the bustle of a Roman military camp on the banks of the Danube, in the year 172 A.D., a plainly dressed man sat in a tent writing. A panting messenger rushed in with news of the battle. "Jupiter be praised, the barbarians have been driven back across the Danube with great slaughter!" The writer smiled at the excited runner and sent him on his way, then turned quietly back to his work.

"If any man," he writes, "is able to convince me and show me that I do not think or act aright, I will gladly change; for I seek the truth by which no man was ever injured. But he is injured who abides in his error and ignorance."

The philosopher-emperor who wrote these lines was Marcus Aurelius Antoninus, whose orders were law all over the Mediterranean world. He was the last of the "five good emperors," beginning with Trajan in 98 A.D. Their combined reigns mark the golden age of the Roman Empire. Marcus Aurelius had been admirably educated by his uncle and adopted father, the Emperor Antoninus Pius, and despite the famines, pestilences, and wars which plagued his reign, he put such reforms and good government into effect that after his death in 180, the Roman populace insisted upon worshiping him as a god.

As a philosopher Aurelius was a disciple of the Greek Stoics, and in his 'Meditations', from which the above extract is taken, he shows how admirably this teaching may be applied to the daily life of any man. He urges the pursuit of virtue, not for praise or reward, but for virtue's own sake. Although he was emperor he scorned comforts and luxuries, working sometimes far into the night to complete the business of state. He says:

"In the morning when thou risest unwillingly, let this thought be present—I am rising to the work of a human being. Have I been made for this to lie in the bedclothes and keep myself warm? Dost thou not see the little plants, the little birds, the ants, the spiders, the bees working together to put in order their several parts of the universe? And art thou unwilling to do the work of a human being?"

In many ways the principles of this pagan emperor approached the nobility of the Christian teachings. Like other Roman emperors of the 1st and 2d centuries, however, Marcus Aurelius persecuted the Christians, because they were suspected of plotting against the government.

In spite of his mild and charitable temperament, Marcus Aurelius was a good warrior, winning many battles against the barbarians who were already beginning to cross in great numbers into the boundaries of the Roman Empire.

MARIA THERESA (*tĕ-rā'sȧ*) OF AUSTRIA (1717–1780). What a host of difficulties surrounded Maria Theresa when in 1740, at the age of 23, she was proclaimed Archduchess of Austria and Queen of Bohemia and Hungary. The young and beautiful but inexperienced queen was surrounded by a circle of enemies. The unscrupulous Frederick the Great of Prussia took advantage of her youth and sex to seize the rich province of Silesia. The "Pragmatic Sanction" by which her father Charles VI had sought to change the Hapsburg rule of succession so as to permit of the rule of a woman, and which had been solemnly guaranteed by France, Great Britain, Russia, and other states, as well as Prussia, was now openly flouted. Bavaria and Saxony laid claims to Austrian lands with France's support; and Spain sought to seize her provinces in Italy. The result was the war of the Austrian Succession (1740–48) in which Great Britain alone fulfilled its treaty obligations.

Maria Theresa was not one to sit idly by while her lands were torn from her. Her husband, Duke Francis of Lorraine, was of little assistance; but her youth, beauty, and dangers aroused the loyalty of her people, and she heightened this by her eloquent and effective appeals. The Hungarian nobles came gallantly to the rescue of their young queen. Her most dangerous enemy, Frederick of Prussia, made peace in 1742, and though he reëntered the war in 1744, his interest centered exclusively in Silesia. When peace was finally made in 1748 at Aix-la-Chapelle Maria Theresa was forced to confirm the cession of Silesia to Prussia, and to give up some of her Italian possessions to Spain, but retained the rest of her lands. Meanwhile her husband, as Francis I, had been elected Emperor of the Holy Roman Empire, with the aid that Prussia had promised.

Her Alliance with France

The loss of her possessions hurt Maria Theresa, and she set herself industriously to win France from its 200 years' enmity to Austria, in order that she might recover them. An alliance with France was brought about in 1756 by her clever minister Kaunitz. This she sealed later (1770) by the marriage of one of her 11 daughters, Marie Antoinette, to the dauphin of France, who later became the unhappy Louis XVI (*see* Marie Antoinette). Unfortunately Great Britain also at this time accomplished a "diplomatic revolution," by which she abandoned her old Austrian alliance and formed a new one with Prussia. When, therefore, the "third Silesian war" broke out in 1756—which broadened into a war between England and France for empire in America, in India, and on the wide seas—Maria Theresa found herself, in spite of an alliance with Russia and the desperate straits to which Frederick was reduced, still unable to force Prussia to loosen its clutch upon Silesia (*see* Seven Years' War).

In another direction Maria Theresa more than made good the loss to her hereditary estates—through her participation in the international crime of the first partition of Poland (1772). But she had the grace to weep over the iniquity which she committed, and in this differed from her fellow conspirators, the rulers of Prussia and Russia. The Peace of Teschen (1779), which averted a war with Prussia, was the last great act of her reign.

Maria Theresa did much to improve the lands she ruled over. She encouraged agriculture and industry, and abolished some of the worst feudal rights which burdened the serfs. She also abolished the use of torture. But she was a "benevolent despot," of the 18th century type, as was also her son and successor, Emperor Joseph II (1780–90) with whom she shared the rule after the death of her husband in 1765, and was careful to do nothing which would lessen her own absolute authority or which savored of democracy or self-government. During the 40 years of her reign she showed herself to be a noble woman, and one of the ablest rulers of her time.

Marie Antoinette (*mȧ-rē′ ȧn-twȧ-nĕt′*) (1755–1793). Near midday of Oct. 16, 1793, a cart crept snaillike through the Paris streets amid the howls and jeers of the populace. In it sat a woman in a ragged white dress with hands bound behind her, yet with traces of majesty in her stricken bearing and of beauty in her wasted face. At the Place de la Revolution the victim descended to mount the steps of the scaffold and lay her prematurely whitened head beneath the knife of the guillotine. That night the grave-digger entered a charge for the bier and grave of the "Widow Capet." Such was the end of a great empress' daughter, once the gayest, most beautiful, and most brilliant princess in Europe.

Marie Antoinette, fourth daughter of Maria Theresa of Austria, was married at 15 to Louis XVI of France, then dauphin or heir to the throne. A frolicsome, reckless, extravagant child, she shocked the soberer members of the French court by her disregard of etiquette. When she became queen (1774), her open favoring of Austrian interests and her enmity to the statesmen Turgot and Necker, and to their measures of reform and economy for relieving the bankruptcy of the country, made her distrusted and disliked. When the French Revolution broke out in 1789, the people came to think that their miseries were in part caused by the extravagances of "the Austrian," "Madame Deficit," or "Madame Veto," as she was variously called.

The frivolous girl meanwhile had become an obstinate woman who forced the king into a reactionary policy, to his undoing. A believer to the core in absolutism, she disliked even liberal monarchists like Lafayette and Mirabeau, and utterly failed to understand the troublous times into which she was flung. In October 1789, hungry Paris fishwives led a march on the royal palace at Versailles to bring the royal family to Paris, that they might more closely be watched. Marie Antoinette's cool courage in showing herself on the balcony for a moment overawed the mob, but did not change their purpose to bring back "the baker and the baker's wife," as in rough jest they called the king and queen. The monarchy's last hope of wise counsel died with Mirabeau in 1791. Less than three months later Louis XVI was persuaded to repudiate the reforms he had promised to accept and attempted to escape with his family from France with a view to war. They were captured inside the frontier and brought back to a darkening fate.

In August 1792, charges of treachery in the war with Austria led a revolutionary mob to storm the Tuileries palace, seize the royal family, and thrust them, prisoners, into the Temple. From there the king was led in December to trial and in January to execution. The queen was taken in August 1793, to the prison of the Conciergerie, where common criminals were confined. Her young son, the dauphin, had been torn from her in July. Amid insults and brutality she bore herself with dignity and patience, but was convicted of treason on the ground that she had participated in plots and conspiracies against France. Her execution followed immediately. Of her guilt there can be no question, but she has never ceased to command the sympathy of posterity, as one of the most pathetic figures in history.

Marigold. In the Middle Ages various golden-yellow blossoms that grew in profusion throughout southern Europe were dedicated to the Virgin Mary and called "Mary's gold" or marigolds. From those developed our own marigold, the sturdy old-fashioned flower which was the delight of our grandmothers. A native of the Mediterranean region, it has been cultivated for over 300 years, and now blooms in our gardens from midsummer until frost. It is often called the "calendula" because it was supposed that its flowers bloom in the *calends* (first day) of each summer month. Its large yellow or orange blossoms have a strong though not unpleasant odor, and the dried leaves were formerly used as flavoring for soups. The marigold curls up its rays at sundown, and in the early morning the dewdrops nestle in the folded petals. Hence Shakespeare speaks of "the marigold that goes to bed wi' th' sun, and with him rises weeping." (*See also* Marsh Marigold.)

A GOLDEN BEAUTY OF LATE SUMMER

The Marigold owes its name ("Mary's Gold") to its dedication to the Virgin Mary. It is particularly prized because it blooms late, when most other flowers have gone to seed.

Scientific name, *Calendula officinalis*. Flowers 1½ to 2 inches across with several series of ray-florets radiating from a central disk composed of numerous yellow stamens: the rays are held in a receptacle of 1 or 2 series of close-growing pointed green bracts. Stem 1 to 2 feet high, erect, branching. Leaves oblong, pointed at either end; growing alternately on the stalk.

Marine corps, United States. Trim, erect, military, the marines are as truly soldiers as any infantrymen, yet they are trained for duty on sea as well as on land. Though these "Soldiers of the Navy" are on duty most often ashore—guarding naval stations, coasts, etc., garrisoning outlying posts, and serving as naval police—yet they perform sentry, orderly, and police duty aboard ships, and sometimes man the guns. Every battleship carries a detachment of marines. The total strength of the corps during the World War was about 70,000.

The marines have long been famous as the "first to fight." If American lives or interests are in danger in any part of the world whatsoever, a United States warship will more than likely send ashore first a landing party of marines and sailors ("jackies")—as at Vera Cruz in 1914. They are usually in the thick of things long before the army forces are sent in.

The Marine Corps is the oldest branch of the United States military service, having been inaugurated in 1775, almost with the foundation of the navy. It is an independent branch, but under the direction of the Secretary of the Navy. In service on land or sea, or both, the marines have distinguished themselves in every war in which the country has been engaged, including Indian wars, campaigns against pirates, and numerous expeditions into foreign lands. They won everlasting glory in the World War, particularly on June 2, 1918, in Belleau Wood, northeastern France, where about 8,000 of them defeated the picked troops of Germany, who dubbed them the "Devil Dogs." Grateful France the next day renamed the wood in their honor—"Wood of the Marine Brigade." For years the marines have helped keep peace in Central American countries, and elsewhere.

The Marine Corps badge or device is a globe resting on an anchor surmounted by an eagle. On their colors is inscribed "Tripoli," recalling that in 1803 they planted the American flag in Tripoli during the war with the Barbary States.

The Royal Marine Artillery and the Royal Marine Light Infantry are the two Marine Corps in the British service. Only in the British and United States services are the marines a specially organized force performing specified functions aboard ship. Other countries sometimes designate as marines their coast defense soldiers and those who garrison forts and colonies.

Marion, Francis (1732–1795). Marion and his little band of men were for months during the Revolutionary War the only force which kept England from completely subduing South Carolina. The service which they rendered in keeping alive the spark of patriotism in the South until Congress could put another army in the field in that section was of inestimable value to the cause of American independence.

The courage which led Marion to support a seemingly hopeless cause was probably inherited from his Huguenot grandfather, who had been exiled from France in 1690 because of his religion. Combined with this courage was a love of adventure which made Marion especially adapted to the kind of warfare which he waged. This love of adventure showed itself early in Marion's life. When he was 16 he ran away from home and sailed for the West Indies. The vessel was wrecked and Marion barely escaped death by starvation. This satisfied his thirst for adventure for a while, and he settled down on his plantation until 1760, when he served in an expedition against the Cherokee Indians.

In 1775 Marion was a member of the South Carolina provincial congress which voted money for raising troops. He immediately took the field as captain, and because of his bravery and skill was rapidly promoted to the rank of brigadier-general. After the capture of Charleston, S.C., in 1780, he took refuge in forest and swamp with a handful of men known as "Marion's brigade." Though his band seldom numbered more than 70 men, it became the terror of the English in that section. When the foe was least expecting it, the men would dart out from forest and swamp, capture a detachment of British troops, or rescue a band of American prisoners and dart back again to their hiding places in the swamp where it was impossible to track them. As Colonel Tarleton, the British commander said, it was impossible to capture the old "swamp-fox."

After the close of the Revolution Marion was commander of Fort Johnson, served several terms in the state senate, and was a member of the state constitutional convention in 1790. His exploits during the war have been stirringly told by the poet William Cullen Bryant in "The Song of Marion's Men."

Marlborough (*märl'bō-rŭ*), **First Duke of** (1650–1722). When John Churchill at the age of 15 became page of honor to the Duke of York (later King James II), he was known merely as a poor and ambitious lad of good family, handsome features, and polished manners. When he died, nearly 60 years later, he had been made Duke of Marlborough and was renowned throughout Europe as the greatest general of his age and one of its greatest statesmen.

Many things helped him in this phenomenal rise. The friendship of the Duke of York for his sister Arabella won for him his appointment as page and later, at the age of 17, a commission in the army. He learned the art of war while serving with England's French allies under the great Marshal Turenne in a war with the Dutch. His rise at court was further aided by his marriage, at the age of 28, with Sarah Jennings, the clever, beautiful, imperious attendant and bosom friend of Princess Anne.

Churchill himself was a man of unfailing politeness, tact, and good temper, and of great military and political talents. When the follies and tyranny of his old patron turned all England against James II, Churchill took a leading part in the revolution which made William of Orange king as William III. He was rewarded by being made Earl of Marlborough. He was of great service to William III in conquering Ireland, which clung to James II, and as commander

against the French in the Netherlands. But he was never wholly trusted by the new king. There was good ground for this, for Marlborough tried to "carry water on both shoulders," as the saying is, by secretly entering into communication with the exiled king, while openly supporting William III.

When Queen Anne came to the throne, in 1702, she showered the richest positions upon Marlborough and his wife. These included the title of Duke and the position of commander-in-chief of the English forces and the chief influence in the government. His abilities, however, were equal to his opportunities. A Frenchman once said that "he never besieged a fortress that he did not take, never fought a battle that he did not win, and never carried on a negotiation that he did not bring to a successful close."

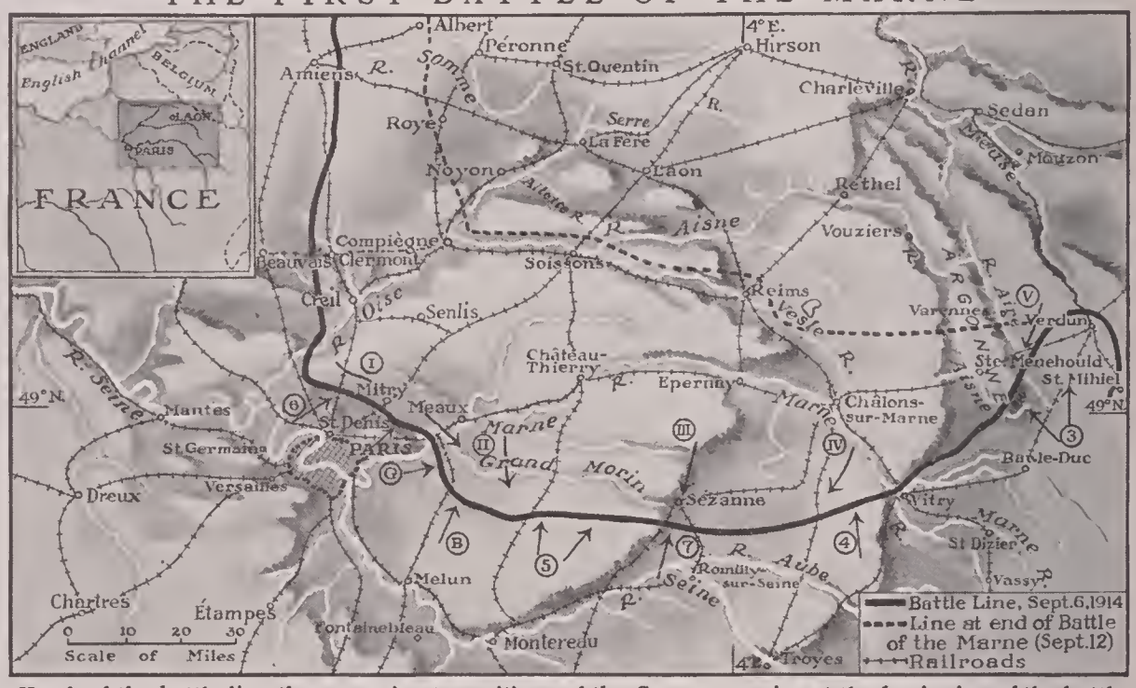
During the War of the Spanish Succession—in which England's chief interest was to prevent France from obtaining Spain, with its vast colonies and dependencies—Marlborough showed his unrivaled generalship in some of the greatest campaigns in English history. On Aug. 13, 1704, as commander of the Dutch and English forces, acting in harmony with Prince Eugene of Savoy, the Austrian commander, he won a great victory over the French at Blenheim, in southern Germany. This battle stamped Marlborough as the first general in Europe. It broke the spell surrounding the great power of France under Louis XIV, and insured the continued exclusion of the "Jacobite" line, descended from James II, from the English throne. The victory also helped to lay the basis for English rule both in North America and in India. Hence the battle of Blenheim has rightly been counted by the historian Creasy one of the decisive battles of the world.

In 1706 the battle of Ramillies, in 1708 that of Oudenarde, and in 1709 Malplaquet, continued Marlborough's career of victory. And as a result of these victories England was able to negotiate the profitable Peace of Utrecht in 1713, which gave Europe peace for 30 years.

Marlborough, however, had fallen from power before this treaty was negotiated. The queen had at last tired of the tyranny of Duchess Sarah, and threw off her yoke. Then Marlborough's enemies succeeded in having him dismissed from power (1711). He was even charged with embezzling public money, but was cleared. When George I came to the throne in 1714, after Anne's death, Marlborough was restored to his military posts. He died in 1722, and his remains now rest in the chapel at Blenheim, the magnificent palace erected for the Duke, near Oxford, at the Queen's expense, before his fall from favor.

Marne River, France. Two crucial and most spectacular battles of the World War of 1914–18 are associated with the Marne River, which winds for 326 miles across the fairest portion of northeastern France. Its general course is steadily westward until just outside of Paris it joins the Seine, of which it is the largest tributary. Connected as it is with the Meuse, the Rhine, and other large rivers by a network of canals, and flanked by important railway lines, the Marne and its broad valley form one of the chief approaches to the French capital—a fact that explains the part it played in the World War.

THE FIRST BATTLE OF THE MARNE



North of the battle line the approximate positions of the German armies at the beginning of the battle are shown by Roman numerals in circles. Thus the numeral *I* indicates the First German Army, commanded by von Kluck, and *V*, the Fifth Army, commanded by the German Crown Prince. South of the line the positions of the Allied armies are in the main shown by Arabic numerals. The numeral 6 represents the new Sixth French Army under General Manoury, which was brought up on von Kluck's exposed flank, and the position of General Gallieni who attacked with the Paris garrison (*G*), and of General French and the British Army (*B*), are shown by letters.

The First Battle of the Marne took place from Sept. 6 to Sept. 10, 1914. The German armies, following their swift drive through Belgium in August, had swept over France and to the very outskirts of Paris. General von Kluck, who was in command of the German right wing, was less than 20 miles from the capital. "Victory is ours!" was the message sent back to Berlin.

Then, suddenly, the unforeseen happened. General Joffre, the French commander-in-chief, who had been doggedly retreating until the favorable opportunity to strike presented itself, sent out this message:

"The hour has come to advance at all costs, and to die where you stand rather than give way." General Gallieni, the white-haired defender of Paris, loaded his troops into trucks, omnibuses, and taxicabs, and rushed them to the front, to attack von Kluck's right flank. At the same time, Generals Manoury, D'Esperey, and Foch, and the British under Sir John French, struck the over-confident Germans on the left flank and in the center. In a great four-day battle the Germans were driven back to the river Aisne, and the first great peril to France was over.

The Second Battle of the Marne took place in July 1918, nearly four years later. The Germans, in a supreme effort to break the deadlock of French warfare before the full force of the United States was cast into the struggle, had launched a great offensive beginning March 21. By July 1, they had crossed the Marne River for the second time in the war, and although they had been halted with the aid of United States troops in the famous battle of Château-Thierry early in June (*see* Château-Thierry), they were within striking distance of Paris.

On July 18, Foch, who had become commander-in-chief of all the Allied forces, threw American and French divisions under Generals Mangin and Degoutte against the Germans' north flank, which crumbled at the first stroke. This was followed immediately by another blow from the south, and on July 25, both banks of the Marne were cleared of the enemy. Then began the general retreat, which with a few interruptions continued until November 11, the day of armistice and victory. The American divisions which took part in the Second Battle of the Marne were the 1st, 2d, 3d, 4th, 26th, and 42d.

The Marne also saw another battle of tremendous importance when Attila and his Huns were crushed at Châlons-sur-Marne in 451 (*see* Huns).

Marquette (*mär-kĕt'*), Jacques (1637–1675). On the white beach of St. Ignace, where the Strait of Mackinac connects the waters of Lake Huron and Lake Michigan, a crowd of gaily-clad Indians and picturesque French traders were gathered, early one morning. In the little bark chapel near at hand the blessing of the Virgin had been asked on the voyage of discovery upon which Marquette, the father of the mission, and his venturesome companion Louis Joliet were embarking. Clad in the long black robes of the Jesuit order, Father Marquette had blessed all his people, red and white. Stepping at last into their birch-bark canoes, the explorers bent to their paddles, only pausing as they rounded the point to wave a last farewell.

It was May 17, 1673, when these two with their five voyageurs in two canoes started on their epoch-making expedition. Paddling along the shore they entered Lake Michigan and safely traversed the wind-tossed waters of Green Bay to Fox River. Ascending that river to near its source, they then "portaged" or carried their canoes on their shoulders across country for about 50 miles, to the Wisconsin River.

For seven days the paddles drove the light canoes down the slow-moving Wisconsin. Upon the morning of the eighth day (June 17) the waters widened and the voyageurs suddenly paddled into the muddy current of the mighty stream of which they had heard—the *Missi-sepi*, or Great River. They were the first white men to behold the course of the "Father of Waters" since De Soto's unhappy discovery, 130 years before.

The journey so far had been pleasant. The Indians visited had been friendly and had listened eagerly to the words of the pale-faced "Black-Robe." But the remainder of the voyage, as they traveled hundreds of miles down the mighty stream, was not so easy. Marquette wrote of the "monstrous fish" which they came upon from time to time. They looked with horror upon hideous monsters painted high on the cliffs above the river. They were forced to use caution in approaching the unknown Indian tribes of the region. But usually they were well received by the red men, and were feasted on parched corn and dogs' flesh. To all Marquette preached Christianity, and he gave his promise to the Illinois Indians that he would return to them "within four moons."

As Far as the Arkansas

At length on July 17, having gone almost as far south as the mouth of the Arkansas River, the explorers turned back, for they feared capture by the Spaniards if they continued. They were now convinced that the river emptied into the Gulf of Mexico, and not the Western Sea (Pacific) as they had hoped.

With difficulty they paddled back against the mighty current of the Mississippi. When they reached the mouth of the Illinois River, they turned into it, paddled to its source, and portaged to the foot of Lake Michigan. In the last days of September they regained the little Jesuit mission on Green Bay which they had left five months before.

In that time they had traveled more than 2,500 miles, a distance comparable to that covered by De Soto in the southeast or by Coronado in the southwest. And just as the names of these two are inseparably linked with the regions they traversed, so the names of Father Marquette and his companion Joliet are linked with the upper course of the Mississippi. (For Marquette's route *see* historical map with article United States.)

The expedition proved fatal to the frail Jesuit father. He did return the next winter to the Illinois Indians as he had promised, but on his way back to the mission at St. Ignace, he died in a little hut in Michigan, near the stream which now bears his name.

Marquette was a member of one of the proudest families of Laon, France. Since 1666 his life had been spent among the Indians of the Great Lakes region—at Sault Ste. Marie, at St. Esprit (near the western extremity of Lake Superior), and at St. Ignace. The winter after his death some of his redskin friends carried his body from its lonely grave to the mission which he had established at St. Ignace.

MARRIAGE

IT IS said of the Emperor Augustus, who was ruling the Roman Empire in the days when Christianity came into the world, that as he lay dying he turned to his weeping wife and, in the last words he ever spoke to her, said, "Remember our happy married life." Then, in the last words he ever spoke at all, he asked after the health of a little boy. This strong man of a world-wide empire, as he passed out of the world in which he was so great a figure, thought of a woman and a child.

There is something in that which stirs our hearts and gives us a true vision of the things of this world. The things that dazzle the eyes of men, the glittering heights of power, were as shadows to the man whose dominion slowly vanished from his grasp; but the simple love of his wife, the thought of a little boy, the happy home-life that had been his mainstay through all the joys and sorrows of this world—these things he remembered.

From the Famous Painting 'Wedded' by Lord Leighton

History takes no notice of it, but it was something for a woman to have achieved; it was something that, through all the storm and stress of Augustus Caesar's life, a woman's love should have woven itself about him, should have impressed itself upon him, should have become so much a part of him that at the end, in the solemn silence of the last hour, it was not the Roman Empire that he thought of, not the power and the glory of the throne of Caesar, not the great days when he stood up in the Forum, Master of the World—but the love of the woman who had helped him, trusted him, and sustained him.

When we come to look out upon the world and make our choice, we should look far and think long. Forever and ever we are choosing; all the golden years ahead we are pledging then. We should not pledge them lightly; we must not engage our manhood or our womanhood, all our precious years, to interests not really ours. We must not let the emotions of an hour determine the course of our whole life.

There is no courage shown on a battlefield greater than the courage we may need in our choice of a companion through this world. It is hard to do right when every hour of our future is calling out to us to beware of the present; but that time may come to all, and especially it may come in these happy days of youth. One of the first elements of human wisdom is that we should not let emotion entirely rule our lives, and the supreme test of our wisdom in this comes in the choosing of a husband or a wife.

It is not enough that there should be between two lives, if they are to be lived as one, a perfect union of hearts. There must be union of mind as well. Not less important than the affections are the interests and hopes and aspirations of the man or woman in whose keeping we entrust our life. A hundred times we hear it said of a man that he has a good heart, and there can be no happiness anywhere without good hearts. But it is vital that we should know the mind as well as the heart. Nothing but sorrow can come, however deep the love of two hearts may be, if the minds have nothing in common—and often, alas! this is discovered too late!

For any subject not found in its alphabetical place see information

It will always be true, no doubt, that love will rule the world, but even love is not beyond the reach of wisdom. We need not love flatterers or praters, or give our feelings to all who ask; and you would not let pure love guide you against your better knowledge. It is not true to say that we marry for love and nothing else; we marry for love and many other things. It is true that without love no marriage can be happy, but it is at least equally true that even with love marriage may be unhappy. Shakespeare put only half the truth into the mouth of Henry V when he wooed Katharine of France in his playful way, but his merry words have an honest, sincere ring about them.

"And while thou livest, dear Kate, take a fellow of plain and uncoined constancy; for he perforce must do thee right, because he hath not the gift to woo in other places; for these fellows of infinite tongue, that can rhyme themselves into ladies' favours, they do always reason themselves out again. What! A speaker is but a prater; a rhyme is but a ballad. A good leg will fall; a straight back will stoop; a black beard will turn white; a curled pate will grow bald; a fair face will wither; a full eye will wax hollow; but a good heart, Kate, is the sun and the moon; or, rather, the sun, and not the moon; for it shines bright and never changes, but keeps its course truly."

King Arthur on the Love of a Manly Man

Even a king, at such a time in his life, may be forgiven for remembering his own special virtues; but we may hope that Kate, in her surrender, had a vision of a kingly mind presiding over a kingly heart. Most of us will love King Arthur's lover better, perhaps, than King Harry's: we remember how Tennyson made him teach the knights of his Table Round:

> To love one maiden only, cleave to her,
> And worship her by years of noble deeds,
> Until they won her; for indeed I know
> Of no more subtle master under heaven
> Than is the maiden passion for a maid,
> Not only to keep down the base in man,
> But teach high thought, and amiable words,
> And courtliness, and the desire of fame,
> And love of truth, and all that makes a man.

We may not be romantic or imaginative or intellectual or artistic; but we may have a common love of those who have these qualities, and it will help us all our way through life if we remind ourselves constantly that the things that are in our minds are as vital a part of health and happiness as the things that are in our bodies. We should take great care that we know the physical health of the man or woman we choose to marry—we should not be afraid, at all costs, to assure ourselves on this, remembering how terrible the price of carelessness may be.

A clever good woman may marry a clever good man, and the end of it may be disaster. "I married for ambition," said Mrs. Carlyle. "Carlyle has succeeded beyond all that my wildest hopes ever imagined for him, and I am miserable." It is sad and strange how something in the mind of a man, meeting something in the mind of a woman, may bring two lives clattering to ruin; and perhaps it may come unexpectedly for want of thought that might have saved its fearful consequence.

Listen to the Wisdom of Experience

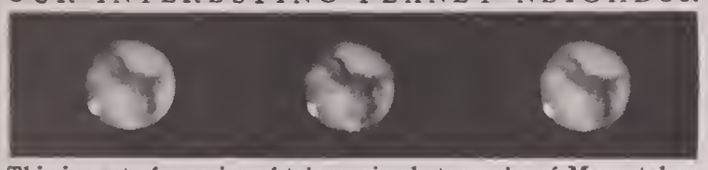
A thousand things we must resolve for ourselves in making this great choice, and no one can resolve them for us; but we should listen with patience to the wisdom that comes of experience. In the end we shall choose our own path, as each of us must throughout this world, but we should not resent the advice and appeal that those who have traveled farther may be led to offer. It is sometimes true that we are unable to decide what is best for ourselves, and at that time we must wait. We need not surrender our choice, we need not abandon the final responsibility which it is right that we should take upon ourselves. But at such times a simple sense of duty may compel us to pause and consider before we take a step that can never be retraced.

We may think, in the end, that we know our feelings best, and may determine our own course; but we shall never regret that we listened to the counsels of those who have no other interest than our happiness, and we may regret in bitterness if we do not. Especially, if the opportunity comes, we should eagerly listen to the advice of a wise old doctor, whose word, particularly if he knows where our affections are set, may be like the touch of a magician's wand in its effect upon our life. Terrible sometimes are the results of want of care.

We shall be wise to wait and not be impatient; we should choose a good heart and a good mind. And in the end we may live with our life's companion through years so happy that our friends shall come to say, as it was said of Lord Tennyson and his wife, that "the peace of God came into their lives when they married."

MARS. Next in importance to Jupiter in the Roman religion was Mars, the god of war. He was regarded as the father of the Romans, through his son Romulus, the legendary founder of the city, and was worshiped with great honor. He was in early times a god of nature and fertility, as well as of the vigor of war. Thus March (Latin *Martius*), the season when agriculture as well as warfare was resumed after the inactivity of winter, was dedicated to him and known by his name.

OUR INTERESTING PLANET NEIGHBOR



This is part of a series of telescopic photographs of Mars, taken to study the changes in appearance due to rotation. These changes are too slight to be conspicuous here, but you can see the white spot of the Martian "polar region" very distinctly. The dark belt around the middle is supposed by some to be a vast region of dense vegetation about the planet's equator.

The Greek god Ares is identified with Mars. But the Greeks thought of Ares only as a sender of war and pestilence, a quarrelsome god, delighting in the slaughter of men and the destruction of cities. He was not widely worshiped in Greece, although the Areopagus, the sacred hill of Athens, was named from Ares.

In astronomy the name Mars is given to the fourth planet in order from the sun, lying just beyond the earth—supposedly because of its red and angry countenance. (*See* Planets.)

MARSEILLES (*mär-sālz'*), FRANCE. Sprawling in the sunshine on the shores of the Mediterranean lies the second city of France—romantic, drawling, busy Marseilles, the home during the World War of half the spies of Europe. The masts of the ships in the old harbor are like a forest of slender saplings. The Cannebière, the broad way leading up from the waterside, is filled with sailors from every land in the world, great brown, swaggering fellows who make the water front none too safe for ordinary mortals. The fish dinners and wines of Marseilles are celebrated.

Southwest of the harbor lies the tiny island called Chateau d'If, made famous by Dumas' story, 'The Count of Monte Cristo'. Inside its fortress walls were confined the most dangerous German spies captured by France during the World War.

The history of the town is as dark and swaggering as the sailors in the streets. It is now the headquarters of the trade with the East and with the French colonies in North Africa, 450 miles across the Mediterranean. But long before there was any nation called France, Marseilles traded with strange and distant lands. It was founded, under the name of Massalia, by Greek settlers from Phocaea in Asia Minor about 600 B.C. After the decline of Greece, it sided with Rome against Carthage, Massalia's rival in commerce. But later the Massalians made the mistake of aiding Pompey against Caesar and the city was severely punished for this.

Marseilles (in French, *Marseille*) was Christianized in the 3d century and its first martyr was St. Victor, a Roman soldier put to death in the persecutions of Diocletian. Through the Middle Ages it was part of the region called Provence and it had many vicissitudes, including capture by the Saracens in 735.

The surroundings of Marseilles were arid until 1848, when a canal was completed bringing to it the waters of the Durance River. In the last 50 years the city has grown almost as rapidly as an American town, largely as a result of the opening of the Suez canal. Its chief industries are the making of soap, olive and other oils, and miscellaneous manufactures. It exports woolen goods, ribbons, sugar, and wine. Population, about 550,000.

The FATHER *of* AMERICAN CONSTITUTIONAL LAW

The Man Who Gave to the Supreme Court Its High Place in the American Government—The Far-Reaching Decision in the Case of Marbury vs. Madison

MARSHALL, JOHN (1755–1835). When John Jay, the first chief-justice of the United States, resigned that office to become governor of New York, he gave as his reason that the Supreme Court could never acquire proper influence and dignity! Less than 40 years later John Marshall, the fourth chief-justice, after making that tribunal the world's greatest court, declared that he would rather hold that office than be president of the United States.

No man in all America did so much to reveal the great extent of the American judicial power, or to teach his countrymen the true meaning of the Constitution and the scope and possibilities of the powers granted to the general government. The decisions of the Supreme Court in the 34 years that Marshall was chief-justice—especially during the earlier period—were bitterly criticized by the party of Thomas Jefferson, but today his reasonings and his exposition of the law are accepted almost without dissent. By universal consent Marshall is now regarded the greatest jurist that America ever produced, and one of the greatest in any land.

Marshall's great fame as chief-justice has overshadowed his other services to his countrymen. Like Washington, Jefferson, and Madison, he was a Virginian, and like Patrick Henry he loved best the free life of the sparsely settled frontier about his father's Fauquier county home. He was fond of sports of all sorts, in which he excelled in spite of his loose-jointed and somewhat ungainly figure. He had no adequate education. At the age of 20 he interrupted his study of the law to enlist in the Continental army, in which he rose to be captain. He fought under Washington at Germantown and Monmouth,

and was in the daring dash of "Mad" Anthony Wayne at Stony Point. When the Revolution was over he returned to his law studies and was soon admitted to practice. Presently he won a big land-title case for Lord Fairfax's tenants against their landlord, and this brought him the leadership of the Virginia bar.

Already Marshall had been elected to the Virginia legislature, where he served for eight sessions. In the Virginia convention of 1788, he and James Madison won the battle for ratification of the Federal Constitution against the efforts of Patrick Henry and Richard Henry Lee. President Washington offered him first the post of attorney-general, and then that of minister to France, but Marshall declined both; for, as he said, his position in Virginia seemed "more independent and not less honorable than any other." He did accept an appointment from President John Adams as one of the three commissioners to France in 1797–98, and approved of the answer to the corrupt agent of the Directory, which one of the commissioners summarized as "millions for defense but not one cent for tribute!" (*see* X Y Z Affair). A term in Congress followed, and then came a year's service as secretary of state in Adams' cabinet. Finally, on Jan. 31, 1801—only 32 days before that Federalist president went out of office—he appointed Marshall to the vacant chief-justiceship of the Supreme Court.

JOHN MARSHALL
America's Greatest Jurist

So persuasive was Marshall's personality, and so sound and penetrating his reasoning, that he soon won to his way of thinking the other members of the Supreme bench. In his first great case, that of Marbury *vs.* Madison, he declared it was the duty of the court to disregard any act of Congress—and hence of a state legislature—which it thought contrary to the Federal Constitution. Upon this decision rests the chief power of the Supreme Court today, that of declaring laws unconstitutional. Equally far reaching was the decision in the case of McCulloch *vs.* Maryland (1819) in which the Hamiltonian idea of "implied powers" in the government was fully sustained. "Let the end be legitimate," said the chief-justice, "let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consist with the letter and spirit of the Constitution, are constitutional." From this doctrine comes much of the authority which the government has over commerce, the militia, the acquisition of new territory, and the vast powers exercised in time of war; for it means that the United States is a *nation*, with the powers appropriate to a nation, and not a mere weak confederation of practically independent states.

To Jefferson and those of the states'-rights school of thought, such decisions were profoundly disquieting. "The great object of my fear," wrote Jefferson in 1820, "is the Federal judiciary. That body, like gravity, ever acting, with noiseless foot and unalarming advance, gaining ground step by step, and holding what it gains, is engulfing insidiously the special governments (states) into the jaws of that which feeds them." But what Jefferson feared as a preparation for tyranny, we now regard as a development indispensable for national power and security.

Marshall's legal ability alone would not account for the strong influence he exercised. His clear thinking and his simple kindly personality impressed all with whom he came in contact, and joined to his other admirable qualities produced a character which left an imprint on his country such as few men have ever made.

MARSH MARIGOLD. Early in April the bright yellow cups of the marsh marigold gild the wet borders of rivers and streams, or huddle together on little islands in low swamps and marshes. They are not true marigolds, these attractive saucer-shaped wild flowers, and much less are they true cowslips, though often called by the name of those pretty English blossoms. They look very much like large buttercups, and indeed it is to that family that they rightfully belong. They grow in great profusion from the Carolinas to Iowa, in the Rocky Mountains, and far northward. Plucked from their wet marshy home, the poor little marsh marigolds are sometimes tied in tight bunches and hawked about the city streets. Their crisp glossy green leaves often meet an equally sad fate, when boiled down to a slimy mass and eaten for "greens." (*See* Marigold.)

Scientific name, *Caltha palustris* ("marsh cup"). Flowers 1 to 1½ inches across, with 5 to 10 glossy, oval, petal-like sepals, and numerous stamens and pistils. Stem stout, smooth, hollow, and branched near the top. Leaves rounded, heart-shaped at the base, and growing either on long stems from the root or clasping the stalk where it branches.

MARTEN. The Siberian sable-marten, the most aristocratic member of this branch of the weasel family, furnishes the celebrated sable, the most expensive of all furs. A single skin of this "Russian sable" of fine quality will bring $2,000 or more. A coat of this dark lustrous fur has sold for $75,000. Sable fur is so fine and even that each single hair tapers gradually to a point; that is why sable brushes are the best for painting: they always form a point when wet. Even these brushes, though made up of hair taken from fragments of the least desirable skins, are very expensive.

Martens of various species are abundant in the northern portion of the Old and New Worlds. They

have long slender bodies and short legs, and live mostly in trees, leaping from one to another much like squirrels. Their outer fur is long and glossy, with an abundant soft under-fur.

In North America there are two species of marten, with a variety of local names. The American pine-marten or Canadian sable, similar to the pine-marten of Europe, is about the size of the large house cat. It has a soft deep fur of rich brown, lighter colored below with a tawny spot on the throat, which is largely used as a substitute for Russian sable. It is fond of forests far from the habitation of man, and shows special liking for pine trees. Its range is the northern woods, but even there it now is rare. It feeds upon birds and other animals. It multiplies rapidly, there being six to eight young to a litter.

The black marten, fisher, or pekan, as it is variously called, is the largest of the group, being from two to three feet long, with a bushy tail a foot or more in length. It has no immediate relatives in the Old World. In color it is grayish-brown, with dark markings, its tail tipped with black. It is bold, strong, and aggressive, a skillful hunter; it kills bear-cubs and the Canadian porcupine. It is successful in stealing bait from traps, and is a nuisance to trappers. It, too, belongs to the northern woods, occurs southward in the Alleghenies, and shows preference for regions of hemlock and spruce. The stone-marten is another variety, with hair inclined to grayish-brown and pure white on the breast. It is found in most parts of Europe south of the Baltic.

Scientific name of pine-marten, *Mustela martes;* black marten, *Mustela pennanti;* Siberian sable-marten, *Mustela zibellina;* American pine-marten, *Mustela americana.*

Martinique (*mär-tĭ-nēk'*). Tourists who visit Martinique, one of the small group of island colonies of France in the West Indies, find two spots of great historic interest. The first is the ruins of the quaint old house in which the unhappy Empress Josephine, Napoleon's wife, was born. The other is the scene of desolation that marks the site of the once beautiful city of Saint Pierre, formerly the largest and most flourishing town on the island. It was totally destroyed in 1902 by the eruptions of Mont Pelée, when its "flaming geyser" of molten lava and poisonous gases killed nearly 40,000 people.

Mont Pelée, about 4,900 feet high, is the highest point in a lofty thickly wooded mountain ridge, which gives to the hot rainy little island much of its picturesqueness. Of volcanic formation, Martinique is irregular in shape, with indented coasts, high and rugged. Its area is 385 square miles; the capital is Fort de France (population, about 27,000).

Somewhat more than a third of the island is under cultivation. Sugar, rum, cocoa, coffee, tobacco, and cotton are the leading products. The farms are served by well built roads, and some of the sugar cane plantations have little railroads of their own. The animal life is somewhat deficient in variety, with the opossum and the Martinique blackbird most in evidence. In former times the deadly fer-de-lance serpent was common, but now it has been all but exterminated by the mongoose, which was introduced from India for the purpose.

Martinique was discovered by Columbus in 1502. It was colonized by the French in 1635. They have held it since that time, save for three occupations, in 1762, from 1793 to 1801, and from 1809 to 1814, by the British.

The island is controlled by a governor and general council. The towns have elective councils. The island sends a senator and two deputies to the French parliament. The population of about 195,000 consists chiefly of negroes and half-castes, the whites amounting to about 3 per cent.

Martyrs. "The blood of the martyrs," wrote one of the early Christian Fathers, "is the seed of the church." For, by the heroic courage with which they endured persecution and died for their faith, they won thousands of converts and so Christianity triumphed over Greek and Roman paganism.

The word comes from the Greek and means a "witness." Stephen, who was stoned to death in the days of the Apostles (*see* Acts vii) was the first of the Christian martyrs. Altogether about 14,000 martyrs are included in the records of the Roman Catholic church. Among the most famous are St. Lawrence, who is said to have been roasted on a gridiron in the year 258, during the persecution of the Emperor Valerian; and St. Sebastian, a captain of the pretorian guard under Diocletian, who was condemned to be shot by a troop of archers for his faith. Sebastian's martyrdom has been a favorite subject with painters, who represent him as a beautiful youth bound to a tree and pierced by countless arrows. In 1563 an English clergyman named John Foxe published a 'Book of Martyrs' commemorating those who had died for Protestant beliefs.

Marx, Karl (1818–1883). A brilliant youth, the son of a prosperous Jewish lawyer in Trèves, Karl Marx as a German university student was expected to win success in his father's profession. But his mind wandered away from his study of law to brood upon social and economic problems, and he became the founder of modern Socialism and the greatest of all socialist writers.

"Why are the laborers the poorest of all classes of people?" he asked himself. "Wealth is the product of their labor; yet of this wealth they receive scarcely a sufficient share to maintain life. The balance goes to those who command their labor, the capitalists. The capitalist class, then, is enriching itself by withholding from labor part of its rightful share." Reasoning in some such manner as this, Marx finally came to the conclusion that there was an inevitable conflict between labor and capital. All through history, as he saw it, this class struggle had been going on. It was slave against freeman in ancient times, serf against lord in the Middle Ages; and now between capitalist and laborer the struggle must continue until the

workers should win from their oppressors the instruments of production and establish the socialist state.

These principles were first clearly formulated in the 'Communist Manifesto' drawn up by Marx and his friend Friedrich Engels as the program for the Communist League, which met in London in 1847. This famous document, with its rallying cry, "Workingmen of all countries unite!" marks the beginning of the modern international socialist movement. It "is to modern Socialism what the Declaration of Independence is to America."

But before he became the founder and leader of Marxian Socialism, Karl Marx had passed through many hard experiences, and there were further trials in store for him. He had been editor of a paper in Germany which was suppressed because of its radical tendencies. He then went to Paris, but was expelled from France within two years, and sought another home in Brussels. In the meantime he had married his childhood sweetheart, Jenny von Westphalen, who though of gentler birth than himself and reared in luxury cheerfully shared the poverty which was often to bring them and their children to the verge of starvation. During the attempted Revolution of 1848 Marx returned to Germany, but was ordered to leave that land in 1849. He then settled in London, where he remained to the end of his life.

The "Bible of Socialism"

His death, hastened by overwork and by sorrow over the loss of his wife, came before he had finished his great work on political economy, entitled 'Capital'. This book, completed and edited by Engels, has been called "the Bible of Socialism." It is based on the so-called "materialistic" or "economic" view of history, which emphasizes the idea, as Engels puts it, "that first of all men must eat, drink, have shelter and clothing, and therefore must work, before they can struggle for supremacy and devote themselves to politics, religion, philosophy, etc."; and that therefore the social ideas and institutions of a time are determined mainly by economic conditions. Marx shows that the capitalistic era of production has played a necessary part in social development; but having reached its highest point, he claims, it must be followed by another order. His system is often called "scientific socialism," as opposed to the earlier "Utopian socialism," which sought to bring about its ends without reference to the practical difficulties involved. Unlike the Utopians, Marx looked for no sudden change to an ideal state. Neither did he, like the Bolshevists in Russia, seek to overthrow governments by violent means. (*See* Bolshevists; Socialism.)

MARY, QUEENS OF ENGLAND. In the long list of rulers of England the names of women appear only five times, and two of these five bear the name Mary.

MARY I, called Mary "the Catholic" or Mary Tudor, reigned from 1553 to 1558. She was the daughter of Catherine of Aragon and Henry VIII and was born in 1516. At first she was a favorite with her father, but when none of Catherine's other children lived and this homely sickly daughter was left as his sole heir, he grew to dislike her, especially after he obtained a divorce from her mother that he might marry Anne Boleyn. During the rest of his life, and that of his son, Edward VI (1547–53), Mary was harshly treated, for she clung to the Catholic church after her royal father had severed England from it, with the same fidelity that she remained loyal to her mother after Henry's unjust divorce.

When her young brother died, after his brief reign, almost all England rejoiced that the attempt to put Lady Jane in Mary's place as the heir was defeated (*see* Grey, Lady Jane). Indeed, at her accession Mary was one of the most popular rulers that England ever had; though at the end of her reign she was one of the most hated, and has gone down in history with the gruesome name of "Bloody Mary." In part her loss of popularity was due to her marriage with Philip II of Spain, the champion of the Catholic party in Europe. Englishmen generally disliked this marriage, partly because they were foolishly jealous of foreigners, but still more because they feared that it would force England to take an active part in the wars between France and Spain. These fears were justified, and in the struggle England lost Calais, which had been an English outpost since the days of Edward III. This was a great grief to Mary, who in her last illness declared that when she was dead "Calais would be found graven on her heart."

But most of Mary's unpopularity came from her religious persecutions. She caused the religious laws of her father's and brother's reigns to be repealed. The Catholic religion and the authority of the pope were thus restored. The laws for punishing heretics were also revived, and about 277 Protestants suffered death for their religion, as some Catholics had done in the reign of Henry VIII. The most notable victim of this persecution was Archbishop Cranmer of Canterbury, who had granted Henry VIII his divorce from Mary's mother. Rowland Taylor, Nicholas Ridley, and Hugh Latimer were other notable Protestant martyrs. The result was a wave of horror and disgust which swept over England. In the midst of it all, Mary herself—childless, sick, neglected by her husband, one of the saddest figures of that age of conflict—died realizing the fruitlessness of her efforts.

The Popular Queen Mary II

MARY II was a Stuart, the elder daughter of James II (born in 1662), and became joint sovereign of Great Britain with her husband, when the Revolution of 1688 drove her father from the throne (*see* James, Kings of England; William, Kings of England). The administration was left exclusively in the hands of her husband, Willliam III, but it was Mary who made the reign popular by her youth, good heart, and pleasing manners. After her unfortunate death from smallpox, after only six years of reign, leaving no children, William III as a foreigner and one of cold reserved temperament had a much more difficult task to face than when aided by his wife.

The TRAGIC STORY *of* MARY, QUEEN *of* SCOTS

The Romantic Career of the Bewitching Woman Who was Queen in Two Countries—How She Played with Fate and Lost the Scotch Throne and was Finally Put to Death by Her Cousin, Queen Elizabeth

MARY STUART, QUEEN OF SCOTS (1542–1587). It was with tears and heartbroken cries of farewell, according to the oft-told tale, that Mary Stuart set sail from France to Scotland. A girl of 19, returning like an exile from Paradise to a childhood home for which she had not one affectionate thought — a queen approaching her throne as Cinderella might have crept back to her ashes!

MARY STUART

Mary, the daughter of James V of Scotland and the French princess Mary of Guise, was born Dec. 8, 1542, just after the Scottish forces had been decisively defeated at Solway Moss in an attempted invasion of England. Seven days later the king died, leaving Scotland and its infant queen as prizes to be fought over, not only by England and France, but also by Scotch lords and clerics. The English demanded that the baby queen should be pledged to marry Prince Edward, heir to the British throne, but the Scots decided to maintain the French alliance and chose the French heir as her future husband.

Even in childhood, the "enchantment whereof men are bewitched" was manifest in her. "This small Queen of Scots," wrote her mother-in-law, Catherine de Medici, "has only to smile in order to turn all French heads." Married to the Dauphin in 1558, at the age of 15, Mary became queen of France, as well as of Scotland, when her husband ascended the throne as Francis II in 1559. A year and a half later she was a childless widow, and the necessities of politics required that she leave the dissolute court of France, no matter how sadly, for her Scottish home.

But the Scotland to which she returned was very different from the one she had left. Her mother, who had acted as regent, had just died; the French interest had waned as the English power under Elizabeth had grown, and the Protestant Reformation for which John Knox and others had long labored was now triumphantly established.

Mary looked upon Protestant Scotland as no more than a pawn to be used in strengthening her position in England. As the granddaughter of Henry VIII's elder sister, Mary was heiress to the crown of England if, as Catholics claimed, Queen Elizabeth was barred as illegitimate. Mary's second marriage, in 1565, to the feeble and futile James Stuart, Lord Darnley, who also had pretensions to the English crown, was meant to strengthen this claim.

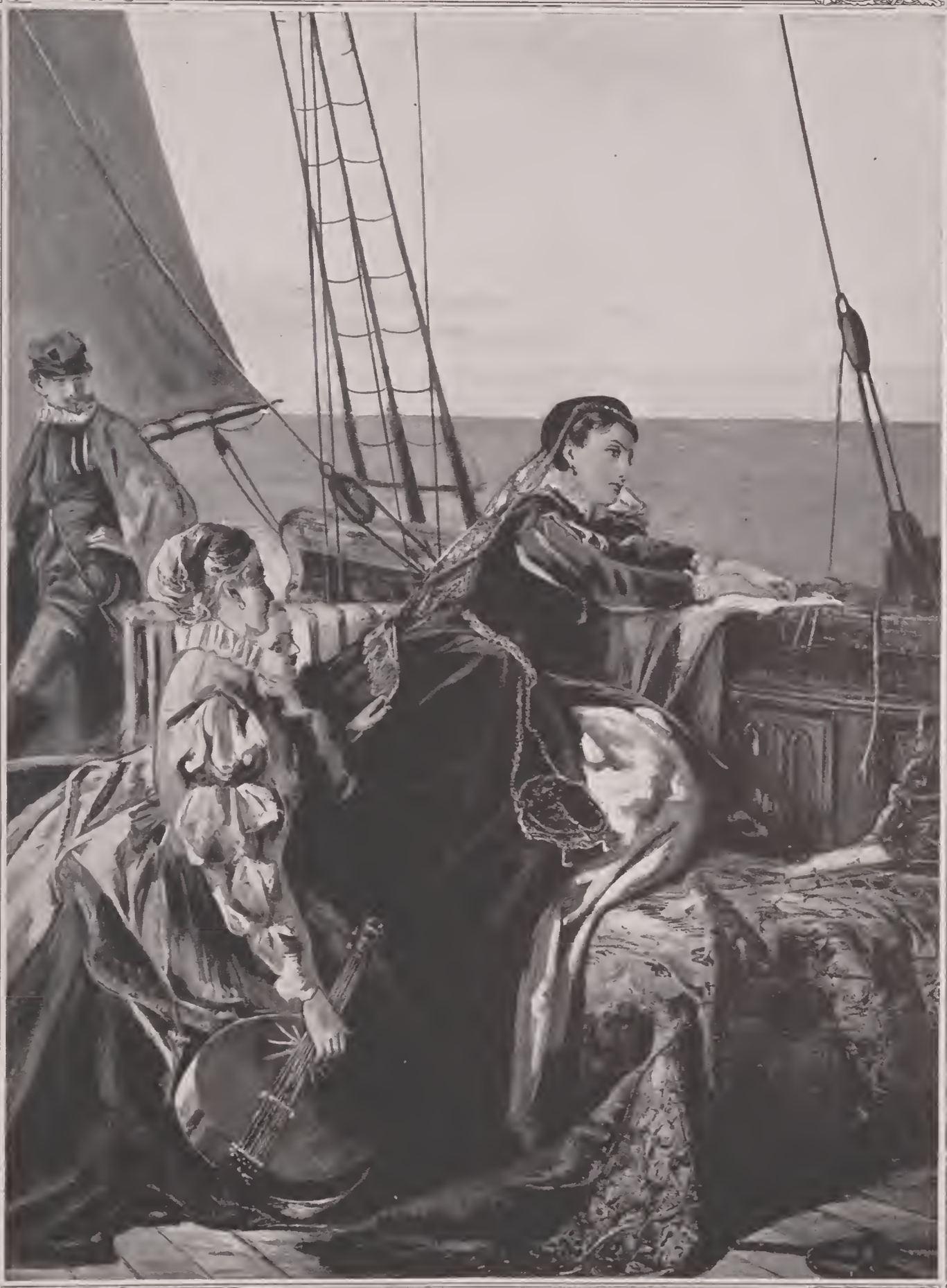
But Darnley's weak insolence and Mary's staunch attachment to Catholicism produced discord between her and her Protestant subjects. Darnley's natural jealousy was fostered by many Scotch lords, Mary's enemies, who pointed to the rapid advancement with which the queen favored her low-born Italian secretary, David Rizzio. Darnley became a party to a conspiracy of nobles, which resulted in Rizzio's murder in Mary's presence. The outraged queen concealed her wrath at this cruel violence. She pretended to pardon Rizzio's murderers, and even flattered Darnley into complete reconciliation. June 19, 1566, Mary's son—afterward James VI of Scotland, who became James I of England—was born. Then in February 1567 she induced her husband, who was ill with smallpox, to take up his residence in an old house at Kirk-o' Field, near Edinburgh. One night the house was blown up and Darnley's murdered body was found near by next morning.

Suspicion against the queen flared into open denunciation and scandal when, three months and six days after the unpunished murder, followed Mary's marriage to the Earl of Bothwell, who had been exposed as the chief of Darnley's assassins. "Burn her! kill her! drown her!" rang through the streets. Bearing before it a banner on which was painted a picture of her little son praying for vengeance on his father's murderers, a rebel army took her prisoner at Carberry Hill. While Bothwell fled to Denmark, she was forced to abdicate in favor of the boy James. Escaping from prison at Lochleven (May 2, 1568) she hastily rallied around her a little army. When this was defeated by the regent Murray's forces at Longside, near Glasgow, Mary fled across the English border and cast herself upon the mercy of her cousin, Queen Elizabeth, who promptly made her a prisoner. The famous "Casket Letters," taken after Bothwell's flight and now produced against her, are damning evidence of Mary's guilt.

For the next 19 years Mary's name was constantly involved in plots for escape and for the overthrow of Elizabeth. The Babington conspiracy in England was only the last and fatal link in a series which at length induced Elizabeth to bring Mary to trial. She was convicted of complicity in the plot for Elizabeth's assassination. So long as Mary lived there could be no safety for Elizabeth, and at last she was prevailed upon by her councilors to sign the death warrant. On Feb. 8, 1587, Mary Stuart, arrayed in black velvet and bearing herself as befits a queen, was beheaded on the scaffold in Fotheringay Castle.

For any subject not found in its alphabetical place see information

QUEEN MARY'S FAREWELL TO FRANCE



After the death of her husband, King Francis II of France, Queen Mary reluctantly gave up the gay life of the French court to return to her troubled throne in Scotland. We see her here on shipboard gazing sadly at the receding shores of the land she loved so well. It seems as if the artist sought to show that the unhappy queen already had a presentiment of the tragedies that were soon to overwhelm her.

contained in the Easy Reference Fact-Index at the end of this work

"Cease to lament," were her last words to her weeping attendants, "for you shall now see a final end to Mary Stuart's troubles. I pray you take this message when you go—that I die true to my religion, to Scotland, and to France." So ended in tragedy one of the stormiest, and yet most romantic and fascinating, careers known to history.

The spell of Mary Stuart's charm rises up out of her grave and reaches across the centuries. Not yet have men ceased to wrangle over her guilt or innocence. The stormy splendor of her tragic fate, her courage and high pride in the face of her enemies, have been a never-ending inspiration to poets and writers of romance. (*See* Knox, John; Scotland.)

GLORIES OLD AND NEW *of "Maryland, My Maryland"*

MARYLAND. Heir to a queen's name and warden of the imperial highway of Chesapeake Bay, with Mason and Dixon's line for its northern boundary, Maryland is like Virginia—but with a difference. Tidewater, piedmont region, and mountains are found also in Maryland, but on a smaller scale, and all are but a setting and background for the upper reaches of the majestic Chesapeake.

Extent.—Greatest length, east to west, about 240 miles; north to south, 128 miles (least width, about 3 miles). Land area, 9,941 square miles. Population (1920 census), 1,449,661.

Physical Features.—Low tidewater region along the Chesapeake and Potomac rising to a central piedmont region and the Blue Ridge and Allegheny mountains (highest point, Backbone Mountain, 3,340 feet). Chesapeake Bay divides the state into two parts. Principal rivers: Potomac and Susquehanna.

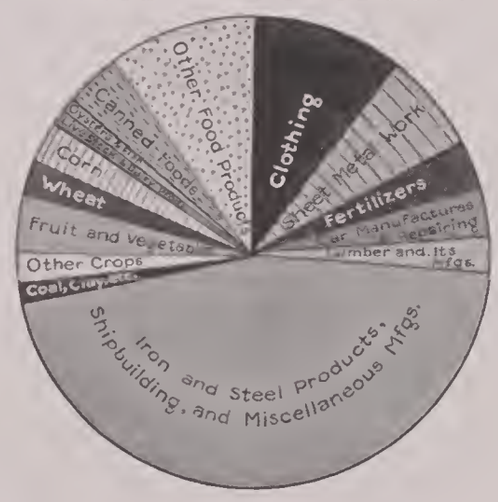
Principal Products.—Corn, wheat, hay, fruit, and vegetables; cattle and dairy products; oysters and fish; coal, iron and steel, copper, tin, and sheet metal products; clothing, canned fruits and vegetables, fertilizers, railway cars, lumber and timber products, boats and ships.

Chief Cities.—Baltimore (735,000), Cumberland (30,000), Hagerstown (30,000), Annapolis (capital).

As in Virginia, the tidewater region (here nearly half the state) is low and threaded with navigable streams, which enabled the colonial planter to ship from his front door, or at least to send his tobacco down to the landing in hogsheads, each pierced with an iron axle and dragged by a strong mule over a "rolling road." Even yet the tidewater farms and plantations mostly turn their backs on the roads and face the water.

The "western shore" (the peninsula between the Potomac and Chesapeake Bay) still raises considerable tobacco, though truck-farming and fruit-growing have become more important occupations. It is a conservative region, where stray remnants of manorial life and colonial customs are of comparatively recent memory. The inhabitants in the main cling to the ancient faith (Roman Catholicism) of the first colonists who landed in 1634.

MARYLAND'S PRODUCTS



By far the greater part of the state's wealth comes from its many and diverse manufacturing industries.

The "eastern shore" (Maryland portion of the peninsula between Chesapeake and Delaware bays) has a somewhat more mixed population. While it raises a variety of crops, including fruit, vegetables, wheat, and corn, its boast is the quantity and, still more, the quality of the choice table delicacies which it produces. The reedy marshes along the shore swarm with ducks, among them the delectable canvasback, and the waters of the Chesapeake with fish—80 edible species, the finest being the Spanish or bay mackerel, the pompano, and the shad. The epicure's joy, the diamondback terrapin, hides in the mud. One whole town (Crisfield) and half the population of Somerset County, in which it is situated, are engaged in oyster fishing and packing. Nor are they the only town and county on the eastern shore where the oyster industry is important; while (to leave the eastern shore for a moment) Annapolis is a center of the oyster trade, and whole streets are devoted to it in Baltimore. Soft- and hard-shell crabs, white clams, and sea turtles are also caught and shipped from the eastern shore. Wasteful methods of hunting and fishing have diminished the supply of many of these species; but some, shad and terrapin, for instance, are now being artificially cultivated. (*See* Chesapeake Bay.)

The hill or piedmont region of middle Maryland, comprising something like a 40-mile belt across the inland neck of the state, with its western border at the foot of the Blue Ridge, is a substantial farming country, raising fine wheat and grass, particularly where the limestone foundation crops up near the surface of the clayey soil. It also produces fine apples, peaches, and small fruits, corn, and live stock. It is well wooded and threaded with many impetuous little cascading streams, known locally as "runs," which furnish considerable water-power. It is truly "the garden of the Lord," as Whittier called it in 'Barbara Frietchie'. Many of Maryland's mineral products—such as building stone—come from the piedmont belt.

The little ragged strip of mountainous Maryland, running westward from the Blue Ridge to the Alleghenies, contains superb scenery, forests, some fertile farm lands (particularly along the river valleys), and many minerals, the most important of which is coal.

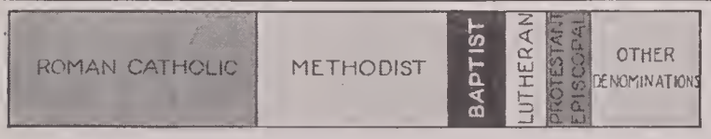
The tidewater region is the "black belt"; the negro population in middle Maryland is sparse and there are scarcely any in the mountains. The negroes constitute less than 25 per cent of the population.

PRODUCTS THAT MAKE MARYLAND PROSPEROUS

The American table owes much to the sea food which comes from Maryland, and particularly to the oysters. Middle Maryland produces abundant crops, as well as good grades of building stone and clay for brick-making. The stone includes limestone and marble, while, of the clay products, Maryland fire-brick is considered among the best in the United States. Coal from western Maryland completes the leading mineral resources of the state. The people of the state enhance Nature's riches with thriving manufactures. Iron and steel in various forms, notably railway cars, are important, as are the tobacco and flour industries, but men's clothing overtops all other industries of the state.

contained in the Easy Reference Fact-Index at the end of this work

A STATE OF RARE COMMERCIAL ADVANTAGES



In the early days of the nation the open road to the sea down Chesapeake Bay drew Maryland inevitably into worldwide commerce, and "Baltimore clippers" were known throughout the seven seas. When railroads were invented, Maryland was one of the pioneers. This progressiveness has always kept the state in an important place. Embracing as it does the District of Columbia, Maryland is at the very heart of the nation's affairs. The smaller map to the left shows the principal streets of Washington, together with the most important buildings.

Little Maryland, with about a quarter of Virginia's land area, has over half as large a population, and one city, Baltimore, which exceeds in size Virginia's ten largest cities put together. Why is this? It would almost seem as if metropolitan and commercial greatness had been forced on reluctant Maryland. As in Virginia, towns were created in colonial days by royal decree, but most refused to live. So unappreciative of commercial opportunities were the early Marylanders that the owner of the land on which it was first proposed to build the city of Baltimore turned the future metropolis away from his doorstep.

But the imperious sea had thrust a beckoning arm up into the land, and would not suffer a home-loving people to sit quiet by their own firesides. By 1812 Baltimore "clippers" were famous ships all over the world; the South and the West, from Knoxville to Cincinnati and Pittsburgh, drew their supplies from the Chesapeake. Baltimore was then the first maritime city of the country, and growing like a miracle. Then other cities, with harbors not so far from the open Atlantic, swung into the lead. The foresight of Maryland citizens, however, retrieved on land much of the advantage lost on sea. The city's answer was the building of the Baltimore and Ohio Railroad, for which ground was broken in 1828, three years after the opening of the Stockton and Darlington railroad in England. This railroad assured the continued development of Baltimore and the state.

The important products of Maryland include iron and steel manufactures, men's clothing, canned and preserved fruits, vegetables, oysters, crabs, and other sea foods, foundry and machine-shop products, flour and grist-mill products, lumber, cigars and cigarettes, and fertilizers. The cheap shipping facilities of Chesapeake Bay make Maryland one of the most important states in the canning industries. After Baltimore, Cumberland and Hagerstown are the most important manufacturing cities (*see* Baltimore).

Coal, bituminous and semi-bituminous, is the most important mineral product. The latter ranks high in steam-making power. Other important minerals are potter's and fire clay, sandstone, marble, granite, roofing slate, brick, and kaolin. The discovery of better iron and copper ores in other parts of the country has made the operation of the Maryland mines unprofitable.

A visiting Englishman once said that the good people of Maryland pride themselves on having been planted by a lord, while their neighboring states were planted by commoners like Walter Raleigh and William Penn. Marylanders, though indignant at

VIEWS IN MARYLAND, WEST AND EAST

A few miles above Washington are the Great Falls of the Potomac, where the river tumbles down 80 feet over a rough ledge and forms a picturesque series of rapids below. The old state Capitol at Annapolis, shown in the lower view, was commenced in 1772. It has been rebuilt recently.

this way of putting it, are willing to admit that there is some advantage in an infant state's having its manners formed at the courts of the lords-proprietors. Annapolis, the successor to old St. Mary's as the capital (now the seat of the United States Naval Academy), was once known as the "Paris of America," and something of the same social tradition clings to Baltimore. Maryland is proud also of its many excellent educational institutions, notably Johns Hopkins University at Baltimore.

Cecilius (or Cecil) Calvert, second Lord Baltimore, desiring a refuge for his persecuted fellow Catholics, secured from Charles I in 1632 a grant of lands embracing the present state of Maryland and parts of Pennsylvania and Delaware, which he named "Maryland" in honor of Charles' wife Henrietta Maria. The first colonists landed in February 1634; and the first "assembly of freemen" met at the newly founded capital, St. Mary's, Jan. 26, 1635. Non-Catholic Christians were given the same civil and political rights as Catholics, and in 1649 Maryland passed the first religious toleration act in the history of America.

But the colony was vexed with enemies. William Claiborne of Virginia, who in 1631 had established a trading post on Kent Island in Chesapeake Bay, refused to recognize the new government; and in 1645 during the Civil War in England lent his aid to Richard Ingle, who seized the capital and government in the name of the English Parliament, and held both for nearly two years. Puritan exiles from Virginia taking possession of Providence (now Annapolis) formed a nucleus for a growing and turbulent Puritan element. With their aid and that of Claiborne the English Commonwealth deposed the Lord Proprietor from 1652 to 1658. The proprietory form of government was abolished for the third time under William and Mary in 1691. It was restored in 1715, when the fifth Lord Baltimore turned Protestant, and lasted until the American Revolution, Catholics being now denied the suffrage and liberty of worship. A dispute with Pennsylvania over the northern boundary line was settled in 1763–67 by the survey of Mason and Dixon's line, a line which later became famous as the boundary between slave and free states.

Maryland took an active and honorable part in the Revolution, the burning of the tea ship *Peggy Stewart*

in 1774 being the colony's answer to the tea tax. A bill of rights and a constitution were adopted in 1776. The state's claim that the western lands should belong to the Union delayed Maryland's entrance into the Confederation until 1781 (*see* Northwest Territory). During the War of 1812 Maryland was exposed to attack by the British fleet and army, and the bombardment of Fort McHenry in 1814 was the occasion for the writing of 'The Star-Spangled Banner' by Francis Scott Key. The first line of electric telegraph in the United States was run from Baltimore to Washington in 1844. Maryland's sympathies during the Civil War were divided, but though a slaveholding state, it adhered to the Union. The battle of Antietam took place on its soil. A new constitution adopted in 1864 abolished slavery. Legislative attempts to enact the "grandfather clause" (restricting suffrage to those whose grandfathers had possessed it) were thwarted by the United States Supreme Court in 1915.

Mason and Dixon's line. In the days before the Civil War the negro slave of the South looked with longing towards Mason and Dixon's line. If he could cross that famous boundary line between Maryland and Pennsylvania, he would be on free soil, and be almost certain of finding friends who would help him on his way to Canada and freedom. Mason and Dixon's line was not always the dividing line between slave and free soil, for its history goes back to colonial days when slaves were owned in all English settlements. It was named from two English surveyors, Charles Mason and Jeremiah Dixon, who in 1763 were hired by Maryland and Pennsylvania to survey and mark the boundary line between those colonies. Their work also included the survey of the boundary between Maryland and what is now Delaware, but this part of the line never had sectional significance because Delaware was a slave state. The name "Dixie" for the South is derived from "Dixon's" line.

Massachusetts. Small in area, but a giant in industry; a picture-book of early American history, yet the home today chiefly of foreign-born residents or of those whose parents were foreign-born; fifth among the states in the value of its manufactures, and last in the proportion of its people engaged in agriculture; 44th in area, 6th in population, and second in density of population—such is Massachusetts, a state of contrasts.

Extent.—North and south, average 47 miles, greatest, 113 miles; east and west, 184 miles. Area, 8,266 square miles. Population (1920 census), 3,852,356.

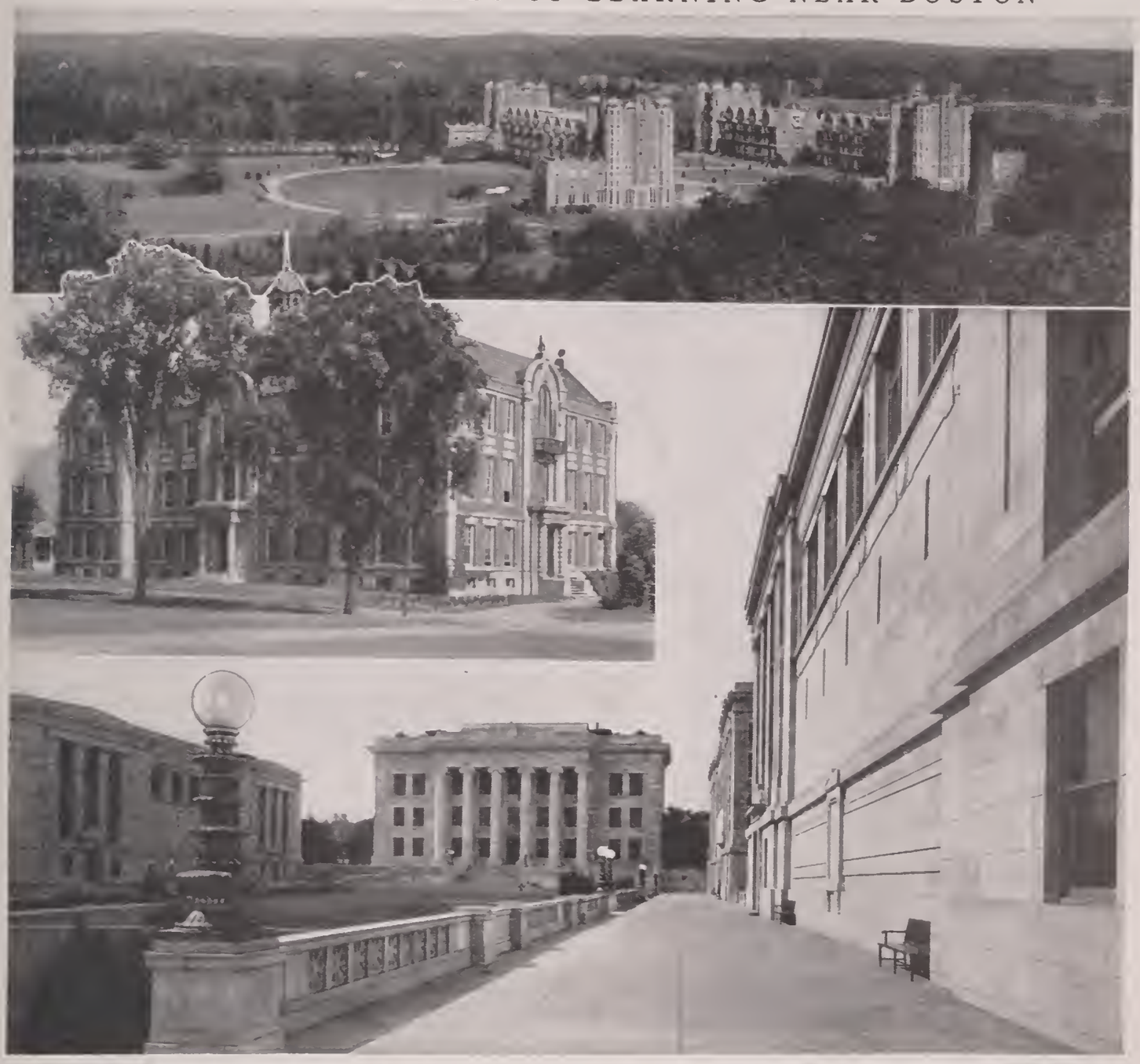
Physical Features.—In the west, Berkshire Hills (Mt. Greylock, 3,535 ft.), Hoosac Range (Spruce Hill, 2,588 ft.), Mt. Tom (1,214 ft.), Mt. Holyoke (955 ft.). Connecticut, Merrimack, Charles, Housatonic, and Hoosac rivers. Cape Cod peninsula and Cape Ann; Cape Cod and Buzzards Bay; Marthas Vineyard and Nantucket islands.

Industries.—Textile manufactures, boots and shoes, printing and publishing, paper-making, manufactures of metal, machinery, wooden goods, jewelry, clothing, cordage; dairy products, garden products, cranberries, tobacco; fisheries; granite quarrying.

Cities.—Boston (capital, 750,000 population); Worcester (180,000); Springfield, New Bedford, Fall River, Lowell, Cambridge, Lynn, Lawrence, Somerville (over or near the 100,000 mark).

When you first visit Massachusetts you are probably most interested in it as a picture-book of historical scenes. You may begin either with Cape Cod, the first part of the "Old Bay State" that the Pilgrim fathers saw and touched in 1620; or with Plymouth, where they made their landing and founded their colony. You may then visit the other early settlements—Salem, founded by John Endicott in 1628; and the neighborhood of Boston settled in 1630. In all these places there are old houses, old street names, and old tombstones to carry the story well back into the 17th century. Still farther inland you find roads which began as Indian trails.

SOME FAMOUS HOMES OF LEARNING NEAR BOSTON



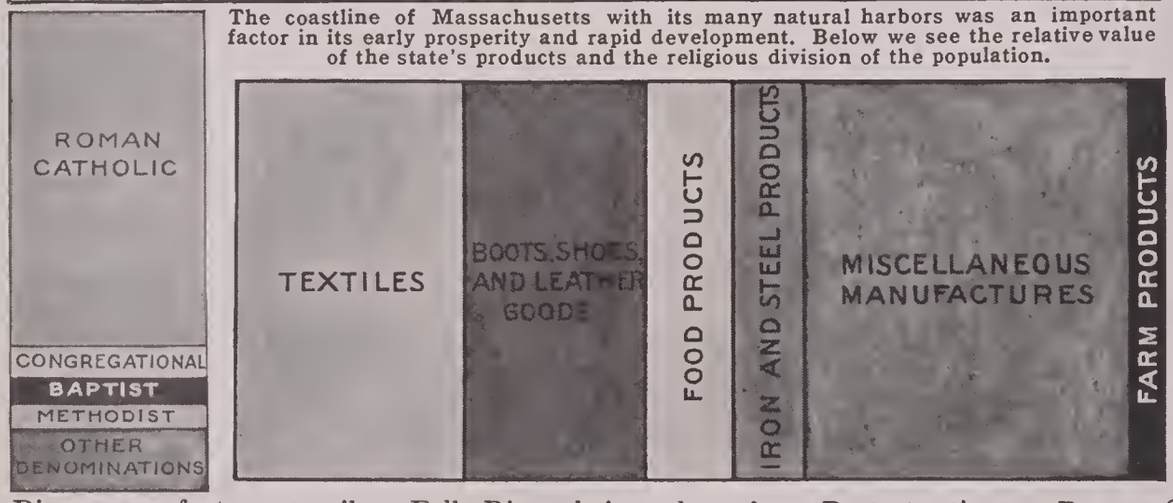
The upper view shows the "Quadrangle" at the famous Wellesley College for girls, near Boston. The four buildings surmounting the crest are dormitories, and the rest of the college buildings are mostly to the right of this group out of sight. The middle picture shows Seelye Hall, a recitation hall of Smith College at Northampton, another famous girls' college. The lower view shows a portion of the Harvard Medical School. The school occupies a site of 26 acres in Brookline, three miles from the main campus. The entire group comprises seven buildings, and in completeness of equipment they are exceeded by no medical school in the world.

The place names, too, have their story to tell. Some, like Boston and Plymouth, tell of ports back in England; others, like Salem—which is another name for Jerusalem—remind you of the religious fervor which first brought Englishmen to these shores. Cambridge recalls that beautiful town in England from whose world-famous university more than 70 devoted men came to cast their lot with the settlers of Massachusetts Bay between 1630 and 1650. Among them were Roger Williams, John Eliot, and John Harvard—the latter the founder of the famous university that bears his name in the new-world Cambridge. Other historic place names commemorate early colonial celebrities, while still others are from the Indian tongue. The name Massachusetts itself comes from Indian words meaning "great hills place," and the name originally applied to a tribe of Indians living between Salem and Plymouth.

Side by side with this history-book Massachusetts is the new industrial Massachusetts, a state of great factories and bustling commerce. More than three-fourths of the population live in cities or large towns. The shoe cities, especially Lynn, Brockton, and Haverhill, turn out almost half the footwear produced in the United States—1,000 acres of shoes every year, or one for every foot in the country! Holyoke and Springfield make a large proportion of our fine writing papers. Lowell, Lawrence, New Bedford, and Fall

A STATE OF VAST AND VARIED INDUSTRIES

The coastline of Massachusetts with its many natural harbors was an important factor in its early prosperity and rapid development. Below we see the relative value of the state's products and the religious division of the population.



River manufacture textiles, Fall River being the greatest "mill town" in the United States. Massachusetts runs one-third of all the looms and spindles in the United States, and makes eight miles of cotton cloth a minute. Worcester is a cradle of inventions. It was the home of the men who invented the cotton gin, the carpet-weaving machine, and the sewing machine. It makes much of the wire, belts, and looms that keep the other factory towns going. Waltham has the largest watch factory in the world. Woburn produces leather, Gloucester is the great port for cod and mackerel fisheries, and Quincy keeps a large number of laborers busy in its granite quarries.

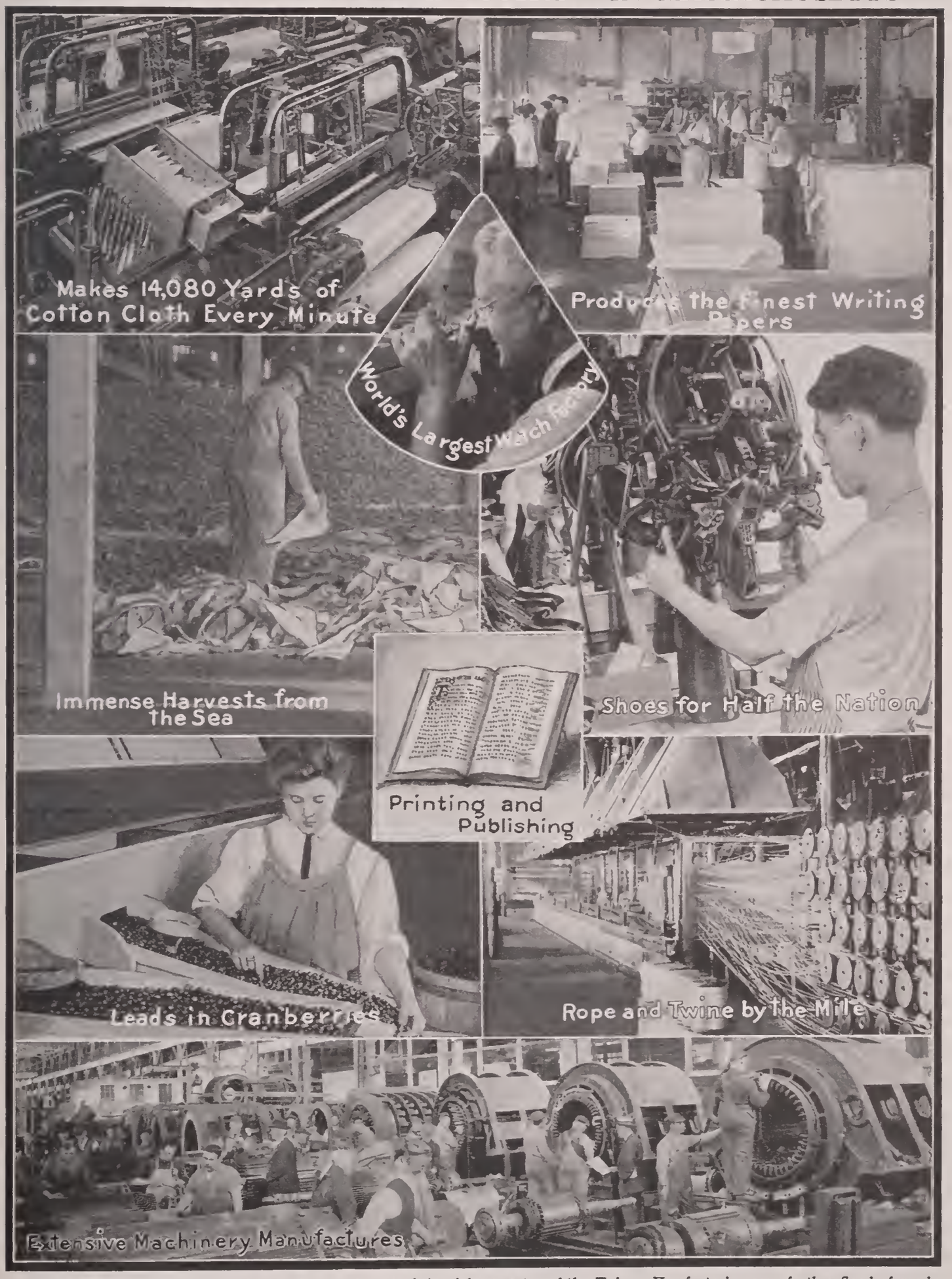
The Industries and the Foreign Population

This new Massachusetts has attracted a great many foreign workers, so that one-third of its inhabitants are now of foreign birth, and another third are of foreign parentage. In certain parts of the state are whole villages of French Canadians, workers in the cotton mills. The Italians employed in the cordage industry at Plymouth form a city of their own, that elbows closely this historic town of the Pilgrims. The Portuguese are more and more taking possession of the fishing and cranberry industries of Cape Cod. Swedes and Finns man the granite quarries of Cape Ann. In Salem you would perhaps find a Polish family living in the house once owned by the man who first sent ships from America to India and China around the Cape of Good Hope. Where Paul Revere lived in Boston is now Little Italy. Most numerous are the Irish, the Canadians, and the Russians. The rigidity of 17th century Puritanism long ago disappeared from Massachusetts' life, and with this influx of foreign immigration the religious balance has passed from Protestantism to Roman Catholicism.

Massachusetts has always been one of the richest states in the Union. Its wealth of late years comes chiefly from manufactures, but its early prosperity came from its fisheries. During their first winter, 44 of the Mayflower colonists died, and the rest would hardly have survived without the wholesome food caught off their shores. By 1633 the colonists had begun exporting fish. As the industry developed, their ships carried abroad the cod and mackerel caught on the Newfoundland Banks, and brought from Spain and the West Indies sugar and molasses, the latter used in making the famous Medford rum. So Massachusetts became a commercial center. In 1784 an enterprising Salem ship-owner sent a vessel to Russia, and a year later the romantic and profitable trade with China and the Orient began. Whaling, once a prominent industry of New Bedford and Nantucket, has now greatly declined.

Massachusetts is interesting not only for itself but also for the fact that it was the cradle of many American institutions and enterprises. The first free

GLIMPSES OF "YANKEE INDUSTRY" IN MASSACHUSETTS



These pictures show plainly why Massachusetts is one of the richest states of the Union. Her factories pour forth a flood of goods that many an entire nation cannot equal—paper, textiles, watches, shoes, machinery, rope and twine, books, and countless others. Among the older enterprises of the state, the fisheries still hold an important place.

contained in the Easy Reference Fact-Index at the end of this work

A TYPICAL NEW ENGLAND VILLAGE

Who has not caught the spirit of the old farming communities of early New England days from the poems of Longfellow and Whittier? Here is one of these little towns, nestling in the low hills, with its old church to symbolize the sturdy religious faith of the early settlers, and its rambling streets flanked by modest wooden dwellings and picket fences.

public school was founded there in 1635, and 1636 saw the beginning of Harvard College. Massachusetts still continues to lead all the states in the number of its colleges and academies of high rank. The town meeting so widely used in local government was also first set up in Massachusetts. In 1814 the cotton industry was revolutionized by the construction and operation at Waltham of the first power loom in America. The first printing done in the English colonies in America was at Cambridge in 1639. This list of achievements might be lengthened almost indefinitely.

In Massachusetts, as in every state, geography has had a great deal to do with the course of development. There are no snow-capped mountains, but the Berkshires in the extreme western part of the state are one of the most picturesque hill regions of America. Their green slopes, little lakes, and shallow stony brooks have often led to a comparison with the famous lake country of England. Summer resorts and great private estates occupy the more remote valleys.

IN THE BEAUTIFUL CONNECTICUT VALLEY

It looks something like a checkerboard, doesn't it, with the fields laid out in little squares? The view was taken looking southwestward across the river valley from a hill near Northampton. The valley of the Connecticut River is one of the more favorable farming regions of the state.

For any subject not found in its alphabctical place see information

WHERE THE BATTLE OF LEXINGTON WAS FOUGHT

Everyone knows the story of the running fight that opened the American Revolution — how the farmers fired on the Redcoat column from behind fences, trees, and bushes until the British returned, badly battered, to Boston. This old stone fence near Lexington perhaps served to shelter its quota of Yankee marksmen on that historic day.

The hills and neighboring mountains give rise to a number of rivers, most of them not navigable, but valuable for manufacturing. Look at the map and you will see how close is the relation between the rivers and the great manufacturing centers.

The hills offer only a thin and stony soil, easily exhausted and hard to till, and therefore point not only toward manufacture but away from any very great development along agricultural lines. Massachusetts is more and more leaving the production of cereal crops to other states, although she is doing an increasing amount of market gardening and dairying. Her many "abandoned farms" are a feature of the countryside. In 30 years, it has been estimated, the tilled land had been reduced one-half.

The sea-coast is as picturesque as the hills. Cape Cod, stretching out like an arm doubled at the elbow, is the most prominent feature of our whole Atlantic coast-line, and its quaint towns are favorites with the summer residents. For fishermen Cape Cod is like a great pier from which they may stretch their nets, and for Boston it forms a breakwater such as the commonwealth could never have built with any amount of money. A canal from Cape Cod to Buz-

AN AIRPLANE VIEW OF BOSTON

This picture shows us one of the newer parts of Boston, southwest of the heart of the city. Even if you could not recognize the buildings, you would know from the long straight streets that this section had been built up since colonial days, for the older part of the city is a crazy-quilt of narrow winding thoroughfares. The domed structure in the center is the Mother Church of the Christian Science faith. In the upper right-hand corner are the freight yards of the Boston & Albany Railroad.

contained in the Easy Reference Fact-Index at the end of this work

zards Bay now removes the dangers to coastwise shipping which have made the Cape a name of ill omen. The islands of Marthas Vineyard and Nantucket—the one about 23 miles long and the other 15—are outlying parts of Massachusetts. Until 1820 what is now the state of Maine was a part of Massachusetts, and for a time New Hampshire was joined to this greatest of the New England colonies.

In history and the literary and intellectual life of the country Massachusetts' part has been no less eminent than in its manufactures and commerce. What would the history of the colonies be without Bradford and Winthrop, and Cotton Mather; without James Otis, the Adamses, and John Hancock; without the "Boston Tea-Party," Lexington and Concord, and Bunker Hill? What voice has ever carried so far or with such weight in the nation's history as that of Daniel Webster? Where else in America can we find such a galaxy of literary lights as Longfellow, Whittier, and Lowell, Hawthorne and Holmes, Emerson and Thoreau, Bancroft, Prescott, Motley, and Parkman? The mere enumeration of the state's chief colleges and universities is impressive. After Harvard, came Williams, at Williamstown (1793); Amherst, at Amherst (1825); College of the Holy Cross, at Worcester (1843); Tufts, at Medford (1850); Massachusetts Institute of Technology (1861); Massachusetts Agricultural College, at Amherst (1863); Clark University, at Worcester (1887). The following are for women: Mt. Holyoke College, at South Hadley (1837); Wellesley College, at Wellesley (1870); Smith College, at Northampton (1871); Radcliffe College, affiliated with Harvard; Simmons College, at Boston (1899).

The landing of the Pilgrims at Plymouth in 1620, the founding of Salem by Endicott in 1628, and the "great emigration" of John Winthrop and the holders of the Massachusetts Bay charter in 1630, mark the beginnings of the settlement. The banishment of Roger Williams, and the hanging of Quakers and witches are events of the Puritan rule which today are deplored. The colony charter was forfeited in 1684, and for several years Massachusetts suffered from the tyranny of the royalist governor Sir Edmund Andros. The Revolution of 1688 in England, however, brought relief. The Plymouth Colony and the province of Maine were annexed to the Massachusetts Bay Colony in 1692, under the new provincial charter granted in 1691. This charter reflected a marked softening in the older religious intolerance.

Massachusetts took a leading part in the resistance to the arbitrary measures of the mother country which led to the American Revolution. It was one of the first to erect an independent state government, but did not adopt a state constitution to replace its colonial charter until 1780. This was revised in 1851 and again in 1917, a moderate form of the initiative and referendum being included in the last revision. The ratification of the Federal constitution by Massachusetts in 1788, accompanied by the proposal of amendments, turned the balance in favor of that instrument and insured its adoption.

The MARVEL *of* MATCHES *and How They are Made*

Little Sticks that Light Most of the World's Fires—Ingenious Machines that Produce Them by the Millions—Eight Matches a Day for Every One of Us

MATCHES. A hundred years ago it was a solemn thing to watch the father of the family start a fire. He took a little iron box down from the high mantel shelf. Inside of it were a bar of steel, a flint stone, and a bit of charred linen or "tinder." He struck the steel on the flint and a starry spark flew off on the tinder. Slowly the glow spread over the tinder until, by blowing on it and feeding it with shavings and splinters, sometimes tipped with sulphur, it burst into flame.

It was such trouble to start a fire with flint and steel that live coals were kept over night under ashes. If a fire went out a little boy was likely sent with an iron kettle to borrow fire of a neighbor a mile or so away. Hunters who lost their tinder boxes were sometimes forced to start camp-fires as the Indians did, by rubbing two sticks together. Any one who has got his supply of matches wet while on a camping trip will understand what a convenience matches are, and will understand why the practiced woodsman keeps his matches in a waterproof box or bottle, and guards them with even greater care than his food.

It had long been known that phosphorus, sulphur, and certain chemical compounds catch fire at low temperatures, but the friction match was not invented until 1827, and the first really practical matches were not put on the market until 1833. For many years most matches were tipped with a mixture of white phosphorus and sulphur, which gave off disagreeable fumes and took fire at very low temperatures. Since white phosphorus gives off highly poisonous vapors which produce the terrible "phossy jaw" disease once common in the match industry, its use has been prohibited in the leading countries of Europe and made impossible in the United States by heavy taxation (*see* Phosphorus). The inflammable tips now usually contain red phosphorus or a phosphorus compound with other chemicals that promote rapid combustion. "Safety matches," which will not easily ignite except when rubbed against the chemically prepared strip on the side of the box, are usually tipped with quick-burning chemicals such as chlorate of potash, while the phosphorus is in the mixture on the rubbing surface of the box. In some European countries "vestas"

WHERE LOGS ARE MADE INTO MATCH STICKS

Those long white ribbons that look like paper or cloth are sheets of wood, shaved off the pine logs in continuous strips by the machine in the background. To the right, workmen are stripping the bark from the log sections and preparing them for the shaving machine. This manner of preparing the wood is used principally for the smaller types of matches. In others, they are split from straight blocks.

This is the chopping machine, where the match sticks are made. On the long table behind the operator are the strips of wood which come from the shaving machine. The machine chops these strips into sticks of the proper length, and drops them out as you see, at the left. The long white tube curving upward behind the machine sucks in a strong draft of air. This draft picks up the match sticks and whisks them up the tube to the floor above.

STRAIGHTENING AND "HEADING" THE MATCHES

We have seen the match wood cut in strips and then chopped into tiny sticks. When these sticks are sucked up through the tube from the chopping machine, they arrive in helter-skelter fashion. In the upper picture this jumble of match sticks is being straightened out by machinery into neat piles. They are then set into holes drilled in iron plates, and the plates are carried on a long belt for over an hour. During this hour the sticks are treated to various baths and processes and at the end they are poked out of the plates into boxes as finished matches. The lower picture shows an operator pouring the phosphorus mixture into the dipping portion of the machine, where the matches are given their "heads." Here you can see the plates traveling on the belt. The match sticks on the left have come through a heating box, then while still hot through a paraffin bath, and now are carried about for a while so the paraffin may dry, before being dipped into the phosphorus mixture. If you look at them closely you will see that they are still headless.

For any subject not found in its alphabetical place see information

A MILLION MATCHES IN ONE MACHINE

Think of the marvel of this machine, which handles a million matches at a time! If all these matches had to be made by hand, they would be so expensive that most of us could afford to use very few. This machine, however, and many others equally ingenious in other parts of the industry, have made matches so inexpensive that we all use them freely, without having to give much thought to their cost.

contained in the Easy Reference Fact-Index at the end of this work

are much used, which consist of thin wax-covered wicks instead of wooden splints. Waxed cardboard is used for "sticks" in many varieties of pocket matches in America.

The making of matches is a fascinating process. Amazing machines do practically all the work. Seasoned blocks of wood two inches thick are put into the front end of the machine and 40 minutes later this wood is converted into matches. Some of these machines have a capacity of a million matches every 40 minutes.

The blocks are fed into the cutting end of the machine under a number of little circular knives, each of which gouges down into the wood and brings up a splint of wood just the size of a match. There are 44 of these little knives and they make up to 250 strokes a minute. As the knives come up bearing the tiny splints, a shelf slides under them and forces their upper ends into perforations in a steel bar, which is in reality a part of an endless chain that takes them on their way. The splints pass through a paraffin bath, which makes them more inflammable, and are then tipped by rollers that bring up the material for the match heads just as the belt brings the splints past that point. After being dried and cooled by blasts of air, and just before the belt comes back to the starting point, the matches are punched out of their bar holders and fall on a shelf, from which they are conveyed to the packing room. Each machine requires the work of only seven people, five of whom are packers. A single factory in the United States can make 100,000,000 matches a day. The pasteboard boxes which hold the matches are made in the same factory at the rate of 400 a minute, in no less ingenious automatic machines. About 400 of the ordinary household matches are usually put into a box which sells for as low as six cents. In earlier times when the matches had to be whittled by hand, they sold by the dozen and were so expensive that people rolled paper lamp-lighters to save their matches.

It has been computed that for every person, big and little, in the civilized world, eight matches a day are needed. Matches are still little used in the remote regions of Austria, Russia, Turkey, and some other countries.

MATHEMATICS. One of the most important facts about the material world is that the objects in it can be counted and the masses can be measured. As soon as men began to count, even on their fingers, mathematics, the first of the sciences to reach formal development, began.

Pure mathematics—the science of number and quantity unconnected with any material object—includes arithmetic, algebra, geometry, trigonometry (these four constitute elementary mathematics), analytic and differential geometry, the theory of numbers, the theory of probabilities, differential equations, differential and integral calculus, infinite series, analysis of complex quantities, etc. (these belong to higher mathematics).

It was the Greeks who first lifted mathematics into the field of abstract thinking. In its higher forms mathematics becomes a form of logic, a method of reasoning, in which the scholar follows through to their result any assumptions that he lays down as basic. In this as in every form mathematics is a test and training in clear logical accurate thinking.

Because number and quantity seemed so tremendously significant, some of the ancients believed that number was the stuff from which the universe was made, or at least the key to its meaning—which seems almost like a fantastic foreshadowing of what modern physical science has discovered—that every invariable numerical relation between physical substances, every physical phenomenon which can be expressed in a finite number, is a clue to facts of the greatest value and meaning. Thus, when Galileo found that the velocity of falling bodies increases in a definite ratio with each stage of their fall, a step was taken toward the discovery of the law of gravitation; and when Dalton found that chemical combinations occurred only in definite ratios between chemical substances, the atomic theory of matter and modern chemistry were born.

Mathematics in the service of the material sciences —as mechanics, electricity, optics, geodesy, and astronomy — is known as applied mathematics. The long and involved calculations necessary in such work have been greatly facilitated by the use of tables of logarithms (invented by the Scotchman John Napier in 1614), which enable the computer to substitute addition and subtraction for multiplication and division. Mathematics is of such fundamental importance in engineering and in almost all physical sciences that it is a necessary preparation for a career in these fields. (*See* Algebra; Arithmetic; Geometry.)

MAURI'TIUS. A little oval emerald, fringed with coral and set in the sea—such is the tropical British island colony of Mauritius, in the Indian Ocean about 500 miles east of Madagascar. Its picturesque beauty, with mountains more than 2,700 feet high, is well known from the description given in Bernardin de Saint Pierre's classic, 'Paul and Virginia'.

Much of the island is still green with bamboo thickets and forests of coconut palm and other tropical trees, despite the areas that have been stripped to make way for the numerous sugar plantations. Sugar is the chief export, and to it the island owes its prosperity. Tropical fruits, coffee, cocoa, corn, rice, spices, vanilla beans, hemp, and yams are also grown, for agriculture engages a majority of the inhabitants. It is one of the most densely populated regions in the world, owing to the Hindu coolies imported to work in the sugar fields. In addition there are Chinese, Malays, negroes, and about 4,000 whites—most of the latter descendants of early French colonists.

Mauritius was discovered about 1505 by the Portuguese, who soon abandoned it. It was occupied in 1598 by the Dutch, who gave it its present name after

their Count Maurice of Nassau. The French were its next masters after the Dutch abandoned it in 1710, and they called it "Isle de France." The English conquered it in 1810.

Mauritius was once the home of the dodo—a pigeon as large as a turkey—and of a large land tortoise and a crested parrot. They are now extinct (*see* Dodo). Terrific hurricanes often sweep over the island. The capital is Port Louis (41,000). Area, about 720 square miles; population, about 385,000.

MAY. The first of May, the fifth month of our year, has always been a gala day. The May Day festival goes back to the Roman festival to Flora, the goddess of flowers, which probably came in the first place from India. In England, as we learn from Chaucer and Shakespeare, it was customary during the Middle Ages for all, both high and low—even the court itself—to go out "a-maying" on the first of this month at an early hour, "to fetch the flowers fresh." The fairest maid of the village was crowned with flowers as Queen of the May. Every town and village had its Maypole on the village green, on which wreaths of flowers were hung and round which the people danced. The Puritans strongly denounced Maypoles and May dances, and they were forbidden by Parliament in 1644, but they once more came into favor with the Restoration under Charles II.

MAY-APPLE. When you go into the woods in early spring you find here and there little green fairy umbrellas, holding one or two large fragrant white flowers between their two shield-shaped leaves. If you visit the woods a little later you will see why these plants are called "may-apples," for under the umbrellas—which now have stems from 12 to 15 inches long—are some tiny yellow apples about the size of a large cherry, egg-shaped fruits having a rather unpleasant insipid taste which, as one writer tells us, are "relished by pigs and boys." In another way these may-apples are useful as well as beautiful, for their leaves and creeping rootstocks are used medicinally.

The scientific name for this perennial herb is *Podophyllum peltatum* and it belongs to the barberry family (*Berberidaceae*). The smooth leaves are 9 to 12 inches wide, the fruit is one-celled and many-seeded. In the United States it is often called "mandrake," but the true mandrake is a totally different plant (scientific name *mandragora*), native to the south of Europe and oriental countries. Many superstitions gathered about the mandrake, such as the belief that it would shriek when uprooted. It is supposed to be poisonous, though the root was formerly used in medicine.

The PILGRIM QUEST *for* RELIGIOUS FREEDOM

What the Sailing of the Mayflower Meant to the Future of Mankind—The Compact that Established and Set an Example for All the World of a Government Of the People, By the People, and For the People

'MAYFLOWER'. In the last three centuries thousands of ships have made their way to America, bearing from the Old World the men and women who have helped to make up the population of the American nation. Compared to most of these vessels, the *Mayflower*, a little sailing vessel of 180 tons, was but a cockle-shell. Yet no other ship's arrival was fraught with such significance as that of this little vessel, which brought the Pilgrim Fathers to America in the year 1620.

This model is an exact representation of the historic 'Mayflower', and gives you a good idea of the small craft in which the company of Pilgrims, 120 in number, braved the Atlantic and came to America. For 63 days this little cockle-shell was tossed about in Atlantic storms. The model is in the United States National Museum in Washington.

To understand who these Pilgrims were and why they came here, we must go back to the north of England and to about the year 1600. Then it was that a group of earnest men and women began to gather together in secret for religious devotion at the home of William Brewster, which was the old manor house of the little village of Scrooby in Nottinghamshire. Like so many Puritans of that time they objected to the half-way religious settlement of Elizabeth. People like this little congregation were called Separatists, since they wished to have a separate church instead of conforming to an established Church of England. (*See* Puritans.) In thus following the dictates of their conscience, they defied the laws of the realm, and for this they suffered heavy penalties. As William Bradford, himself one of their number, wrote later, "Some were taken and clapt up in prison, others had their houses besett and watcht night and day, and the most were faine to flie and leave their houses and habitations and the means of their livelihood."

Because of these persecutions they were driven at last to leave England. There was one country where

they knew they would be allowed to worship as they chose—that was Holland; and to Holland they managed, after some difficulties, to escape in 1608. From Amsterdam, where they landed, they went to Leyden, and there established a settlement and a church under the leadership of their beloved minister, John Robinson.

But though they found freedom in Holland, it was not and could not be really home to them. Life there was very hard. Most of them had been farmers, and they were now forced, in this industrial and commercial community, to follow occupations to which they were unaccustomed, and by which they could earn only a bare subsistence. Worse still, their children were in danger of falling away from their faith, and they were growing up Dutchmen instead of Englishmen. So after long discussions it was decided to go out into the wilds of the New World, where they might preserve their native language and customs and have freedom to worship as seemed right to them.

After the necessary permission to settle had been obtained and all preparations made, on a bright July day in 1620 they set sail in a little ship called the *Speedwell*. At Southhampton, in England, they found another ship awaiting them, the *Mayflower*, with a number of Separatists from London, who wished to join the expedition. But the vessels had proceeded only a short distance when the *Speedwell* began to leak. Twice they were forced to turn back, and finally, abandoning the *Speedwell*, the *Mayflower* set sail from the harbor of Plymouth, England, on September 6th.

It is hard to realize today the hardships and perils of that voyage. The delays had brought them to the time of the equinoctial storms. The *Mayflower* was considered a sturdy ship for her day, but little advance had been made in ship-building since the time of Columbus. For two months and five days the weary voyage continued. Living in the stifling air of their close quarters, amid the tossing ocean, many of the Pilgrims fell sick. One man, William Butten, died; and a baby, named Oceanus Hopkins, was born.

At last they reached the bleak and desolate shores of Cape Cod, and the evening of November 19 found them safely anchored in the sheltered harbor just within the tip of the cape, where Provincetown now stands. But their troubles were far from being over.

"Being thus passed the vast ocean, and a sea of troubles," writes Bradford, in the quaint language of that time, "they had now no friends to wellcome them, nor inns to entertaine or refresh their weather-beaten bodys, no houses or much less townes to repaire too, to seeke for succoure. And for the season it was winter, and they that know the winters of that countrie know them to be sharp & violent, & subjecte to cruell & fierce stormes, deangerous to travill to known places, much more to serch an unknown coast. Beside, what could they see but a hidious and desolate wilderness, full of wild beasts and wild men? and what multituds ther might be of them they knew not."

Their grant from the London Company was to settle in some place in "Virginia," but they had come to land north of that province. They wished to sail south to the Hudson; but the master of the ship refused and declared they must seek out a place of settlement where they were. In a little boat called a "shallop" they explored the wintry waters of the bay. Such a site as they sought was found at Plymouth, across the bay. To that harbor the *Mayflower* was then moved, to begin the settlement that meant so much for America.

Before leaving the ship as "loyall subjects of our dread soveraigne Lord, King James," the heads of the Pilgrim band set their hands to the famous "Mayflower compact." In this they promised to "combine ourselves togeather into a civill body politick, for our better ordering and preservation and furtherance of the ends aforesaid; and by vertue hereof to enacte, constitute, and frame such just and equall lawes, ordinance, acts, constitutions, and offices, from time to time, as shall be thought most meete and convenient for the generall good of the Colonie, unto which we promise all due submission and obedience." This is said to be the first written agreement ever made providing for the government of the people and by the people, and so it is a priceless heritage. (*See also* Plymouth, Mass.)

The List of the Mayflower Pilgrims

A General Society of Mayflower Descendants was formed in 1879, with branches in many states of the Union. William Bradford, himself one of the immortal Pilgrim band, gives us in his 'History of Plymouth Plantation' the following list of Mayflower Pilgrims, 102 in all.

The names of those which came over first, in the year 1620, and were by the blessing of God the first beginers and (in a sort) the foundation of all the Plantations and Colonies in New-England; and their families.

Mr. John Carver; Kathrine, his wife; Desire Minter; and 2. man-servants, John Howland, Roger Wilder; William Latham, a boy; and a maid servant, and a child that was put to him, called Jasper More.

Mr. William Brewster; Mary, his wife; with 2. sons, whose names were Love and Wrasling; and a boy was put to him called Richard More; and another of his brothers. The rest of his children were left behind, and came over afterwards.

Mr. Edward Winslow; Elizabeth, his wife; and 2. men servants, caled Georg Sowle and Elias Story; also a litle girle was put to him, caled Ellen, the sister of Richard More.

William Bradford, and Dorothy, his wife; having but one child, a sone, left behind, who came afterward.

Mr. Isaack Allerton, and Mary, his wife; with 3. children, Bartholmew, Remember, and Mary; and a servant boy, John Hooke.

Mr. Samuell Fuller, and a servant, caled William Butten. His wife was behind, and a child, which came afterwards.

John Crakston, and his sone, John Crakston.

Captin Myles Standish, and Rose, his wife.

Mr. Christopher Martin, and his wife, and 2. servants, Salamon Prower and John Langemore.

Mr. William Mullines, and his wife, and 2. children, Joseph and Priscila; and a servant, Robart Carter.

Mr. William White, and Susana, his wife, and one sone, caled Resolved, and one borne a ship-bord, caled Peregriene; and 2. servants, named William Holbeck and Edward Thomson.

Mr. Steven Hopkins, and Elizabeth, his wife, and 2. children, caled Giles, and Constanta, a doughter, both by

If it made the Pilgrims open their eyes when a red giant of the woods stalked in among them like that, how do you suppose they looked when he began to talk English and told them that he wanted to be their friend? And he did become their friend indeed, for this Indian is the famous Squanto. Through him the powerful Massasoit also became their friend. The secret of Squanto's English speech was that he had been captured by an English crew, sold as a slave in Spain, and, escaping to England, had learned the language, before returning to his people.

contained in the Easy Reference Fact-Index at the end of this work

a former wife; and 2. more by this wife, caled Damaris and Oceanus; the last was borne at sea; and 2. servants, caled Edward Doty and Edward Litster.

Mr. Richard Warren; but his wife and children were lefte behind, and came afterwards.

John Billinton, and Elen, his wife; and 2. sones, John and Francis.

Edward Tillie, and Ann, his wife; and 2. children that were their cossens, Henery Samson and Humillity Coper;

John Tillie, and his wife; and Eclizabeth, their doughter.

Francis Cooke, and his sone John. But his wife and other children came afterwards.

Thomas Rogers, and Joseph, his sone. His other children came afterwards.

Thomas Tinker, and his wife, and a sone.

John Rigdale, and Alice, his wife.

James Chilton, and his wife, and Mary, their dougter. They had an other doughter, that was maried, came afterward.

Edward Fuller, and his wife, and Samuell, their sonne.

John Turner, and 2. sones. He had a doughter came some years after to Salem, wher she is now living.

Francis Eaton, and Sarah, his wife, and Samuell, their sone, a young child.

Moyses Fletcher, John Goodman, Thomas Williams, Digerie Preist, Edmond Margeson, Peter Browne, Richard Britterige, Richard Clarke, Richard Gardenar, Gilbart Winslow.

John Alden was hired for a cooper, at South-Hampton, wher the ship victuled; and being a hopfull yong man, was much desired, but left to his owne liking to go or stay, when he came here; but he stayed, and maryed here.

John Allerton and Thomas Enlish were both hired, the later to goe mr of a shalop here, and the other was reputed as one of the company, but was to go back (being a seaman) for the help of others behind. But they both dyed here, before the shipe returned.

There were allso other 2. seamen hired to stay a year here in the country, William Trevore, and one Ely. But when their time was out, they both returned.

These, being aboute a hundred sowls came over in this first ship; and began this worke, which God of his goodnes hath hithertoo blesed; let his holy name have the praise.

MAY-FLY. Those delicate-winged insects, with long threadlike tails, which in many places suddenly appear in clouds in late spring and early summer, filling up the globes of arc-lights, settling in helpless masses on windows and sidewalks, or covering the surfaces of ponds and lakes with their bodies, are called "May-flies," "shad-flies," or "day-flies." This last name comes from the extraordinarily short life of the adult insect, which was formerly believed to last but a day, and which, in fact, is rarely longer than a week. The adult May-fly is incapable of taking any food, either solid or liquid, hence its brief life.

But if the final stage of its life is short, the early stages are long. Among the 300 or more species of May-flies are some that spend three years in the larval stage after hatching from the eggs.

The eggs are laid in large numbers in the water and sink to the bottom. The larvae are strong and active creatures which spend their time swimming about, crawling on the bottom, or burrowing in the ooze in search of the smaller forms of animal and vegetable life on which they feed. When full grown, they rise to the surface, burst their skins, and fly away in huge swarms. Lighthouse keepers on the Great Lakes often have difficulty in keeping their lights clear of these swarms. Fish devour May-flies greedily, and many of the artificial flies used by anglers are imitations of these insects.

May-flies belong to a very ancient and primitive type of insect, fossils of their ancestors having been found in the deposits of the Coal Age. They are interesting to scientists chiefly because they pass through what is called a *sub-imago* stage—that is, after the winged adults emerge from the water they shed their skin again, the full *imago* often coming forth in colors very different from those of the *sub-imago*. This is a habit found in no other insects.

MAZZINI (*mät-sē'nē*), GIUSEPPE (1805–1872). Italy was "a mere geographical expression," made up as it was of many small states, when Mazzini, the "Prophet of Italian Unity," lent his aid to the age-long task of rendering it a united nation.

In 1821 the sight of the refugees from the unsuccessful rising in Piedmont led him to give up his promising career as a lawyer and journalist of Genoa, and devote his life to the work for unity and liberal republican ideas. As one of the "Carbonari" (revolutionaries) he was imprisoned in 1830. When set free the next year, his life-plan was settled. His first step was the formation of a revolutionary society called "Young Italy," whose motto was "God and the People" and whose banner bore on one side the inscription, "Unity and Independence," and on the other, "Liberty, Equality, and Humanity."

Mazzini's revolutionary activity made Italy exceedingly dangerous for him, and from 1832 he led the life of an exile. He was the most untiring political agitator in Europe, the man most dreaded by its absolute governments. He was always writing, and his organization soon extended through Italy. For seven years he struggled hard against poverty in England, yet managed to help his poorer ignorant countrymen, the London hand-organ grinders, by teaching them in night classes.

On the outbreak of the Lombard revolt (1848) Mazzini threw himself into the struggle. When the republic was proclaimed at Rome, Mazzini was chosen one of three triumvirs with the power of dictators. On April 26, 1849, however, the French soldiers arrived, and in June the republic fell, and with it the immediate plans for Italian unity.

Ardent patriotism, heroic self-sacrifice, and unconquerable faith in the final triumph of his ideas made Mazzini a great leader of men. His influence was strongest with his own class—the lawyers, doctors, professors, and army officers. He could not work well with others, for he could never compromise. This fault led to difficulties between him and the other two leaders of Italian unity—Garibaldi, its knight-errant, and Cavour, the statesman who conceived the plans which finally made union a reality.

Mazzini was sentenced to death three times. In 1866, after the kingdom of Italy was established, the sentence was formally rescinded, and he died peacefully at Pisa, March 10, 1872.

Meade, Gen. George Gordon (1815–1872). To General Meade belongs the honor of having commanded the United States troops in the greatest battle ever fought on American soil, that of Gettysburg. Just three days before the battle began he received his appointment as head of the Army of the Potomac. This was a most important command, but he was a man of experience and thoroughly trained in war. He had been graduated from West Point in 1835, had served with honor in the Mexican War, and had already won distinction in the battles of Antietam and Fredericksburg in 1862.

It was a critical situation which General Meade was called upon to face when he took command at the end of June 1863. A Confederate army under General Lee was on Northern soil, and the people of the North were panic stricken. When handed his appointment as commander, General Meade —so intense was the criticism directed against all officers of the Army of the Potomac —at first mistook it for an order for his arrest. As commander in the battle of Gettysburg (July 1 to 3, 1863) he more than justified all expectations formed of him. Lee was forced to withdraw from the field, and Meade was left victor in what proved to be the decisive battle of the war. But he failed to follow up his victory and crush the army which he had conquered. This failure led to such bitter criticism of him at the North, even by President Lincoln, that Meade asked to be relieved of his command. His request made the public realize that, while he had not done all that they wished, he had performed a great service in driving back the Confederate army from Northern soil. For this service, three years later, he received a vote of thanks from Congress, and from his fellow-citizens a residence in Philadelphia in which he spent his last days.

Meade was made major-general in the regular army in 1864, and retained the command of the Army of the Potomac, under General Grant, during the battles of the Wilderness, the siege of Petersburg, and other conflicts, until the close of the war. He was in command of the division of the Atlantic, 1865–66; of the department of the east, 1866–67; and later of the military district which included Georgia, Alabama, and Florida. His headquarters after the war ended were at Philadelphia, where he died, Nov. 6, 1872. (*See* Gettysburg, Battle of.)

Meadowlark. "Spring o' the y-e-a-r-r! Spring o' the y-e-a-r-r!" Above the frosty brown meadow the chime-like whistle rings again and again. Although the happy singer on his fence post is the only visible sign that winter is over, we look at once for greening fields and waking brooklets, because for springs uncounted our meadowlark prophet has never failed.

THE HARBINGER OF SPRING

Together with the robin, the Meadowlark is a welcome visitor because when we hear his song in the fields we know that spring is at hand.

He is distinctly an American bird. Although a close relative of the blackbird, and not a lark at all, he has a larklike fashion of nesting on the ground and of singing on the wing above his meadow home.

The meadowlark is about 10½ inches long. His feathers are brown streaked with black, his breast is a bright black-spotted yellow, adorned with a striking crescent of glossy black feathers just below the throat (for illustration in colors *see* Birds). The nest, with its three to seven white brown-spotted eggs, is so cleverly hidden in the grass that you are only saved from stepping on it by the sudden appearance of the mother bird who flies up from almost under your feet. She is a bit smaller than her mate and her plumage is a shade paler.

Besides its beauty and its happy song-call, the meadowlark has another claim to our affection. More than half of its food is harmful insects, and of the other half the greater part is weed seeds, supplemented with grass seed and some waste grain. In spite of its harmless habits the meadowlark was for many years shot as a game bird, but now is protected by law in almost every state.

Meadowlarks breed throughout the United States and in Canada. They migrate from the north as cold weather approaches, though they frequently winter in New England. The western part of America has a slightly different species called the western meadowlark. Its habits and appearance are almost the same as those of the eastern meadowlark, but it is a bit smaller and grayer, and the breast yellow is somewhat deeper. Its song is far more beautiful than that of its eastern relative, and this is one of the distinguishing characteristics which has led scientists to consider it a separate species. Scientific name of meadowlark, *Sturnella magna*.

"PACKING-TOWN" *and Its Myriad Products*

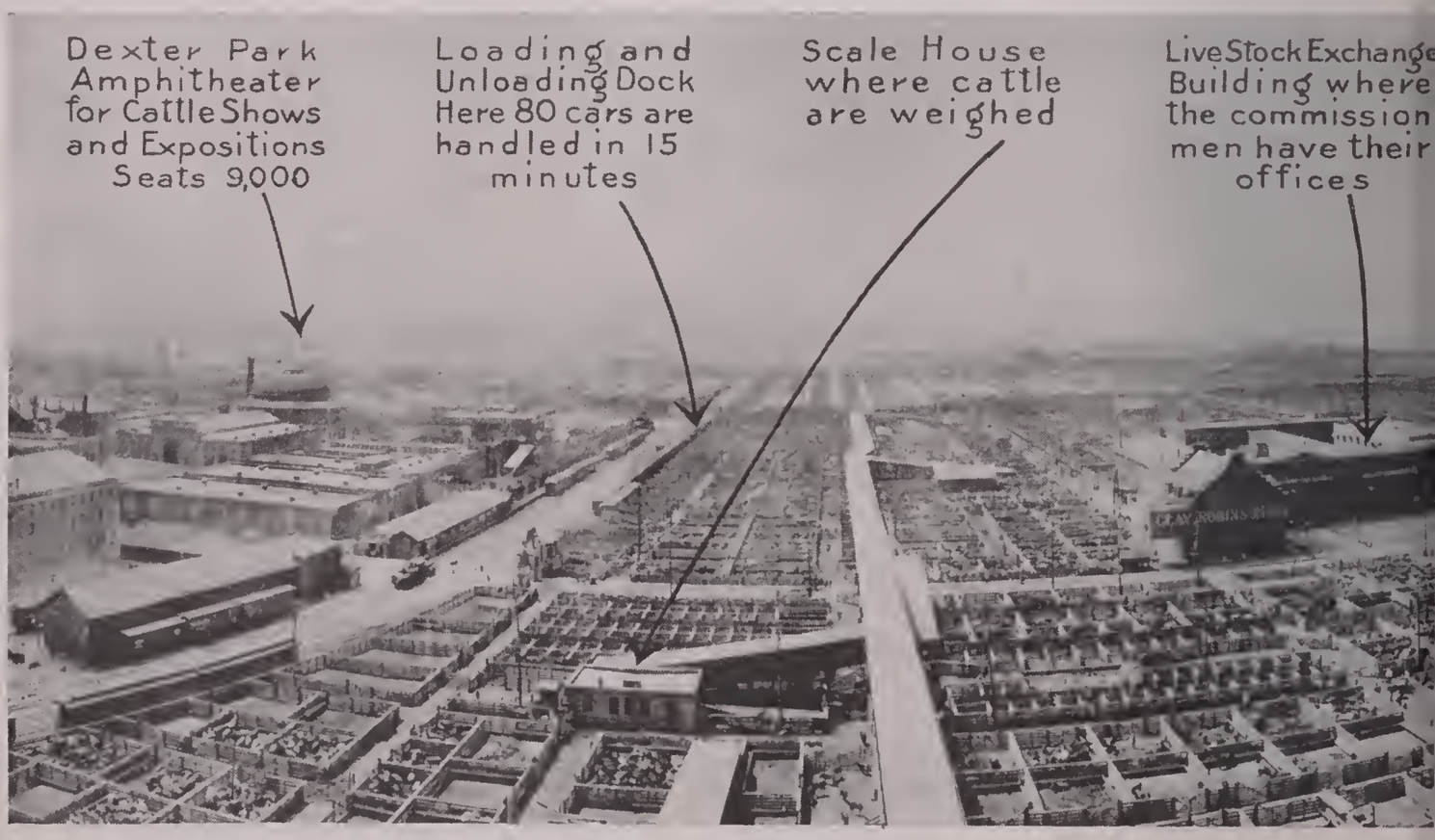
SOMEONE has said that in the great packing houses of today "every part of the hog is made use of except the squeal!" The astonishing degree to which economies, efficiency, and organization have been carried lend some justification to this humorous remark, as the accompanying article shows.

MEAT PACKING. This is a distinctly American industry with Chicago as its chief center. Within recent years the business has grown to proportions which have astonished the world and changed the lives and habits of people in many civilized countries. It covers the whole process of buying, slaughtering, curing, preserving, manufacturing, and selling meats and their by-products. From the packers come most of our fresh meats and poultry, our hams and bacon, lard and lard substitutes, pickled pork and corned beef. They have also supplied our markets with eggs, cheese, butter, and oleomargarine; engaged in the manufacture or marketing of canned meats, soaps, washing powders, and many other canned products, hides, fertilizers, etc. Their buyers are stationed at all of the leading live stock markets gathering up supplies from farm and factory; their salesmen and refrigerator cars carry their products to practically every meat and provision dealer.

People who visit the Chicago stockyards, commonly called "Packing-town," usually expect to find one set of buildings and many stock pens. They see cattle, sheep, and hog pens in abundance, but they are astonished to find that the "yards" is a manufacturing city in itself, with many buildings and streets, banks and stores, telephone and telegraph exchanges. Elevated railways run overhead and elevated sidewalks, pens, and buildings are everywhere. Some idea of the size of this packing center may be obtained from the fact that the Chicago yards comprise 500 acres, and include 300 miles of railway track, 25 miles of streets, and 13,000 pens. They are able to handle each day 75,000 cattle, 125,000 sheep, and 300,000 hogs. If you could stand on the top of one of the buildings, you might be able to count 3,200 railway cars as they arrived in the morning over 21 railway lines. You would see hundreds of salesmen, buyers, and employees, scurrying around on horseback, in motor cars, or afoot. You would also see refrigerator cars, cold storage plants, and even "corrals" where they break untamed horses.

In a single year recently the Chicago yards handled more than 18,000,000 head of live stock, valued at nearly a billion dollars. Of these, 3,500,000 were cattle, 750,000 were calves, 8,700,000 were hogs, and 5,200,000 were sheep. Besides this the yards received and shipped 45,762 horses, for the facilities of the great packing companies are used for trading in live animals as well as packing. All this required 303,948 car loads, or about 7,500 trains. These figures give us some idea of the size of the nation's packing business. And all the live stock received in Chicago and other cities is paid for in cash each day.

PANORAMIC VIEW OF THE GREAT UNION STOCK



The United States is at once the greatest meat-producing and meat-eating country in the world. It not only supplies its own needs, but furnishes a great deal of the meat consumed in other countries as well.

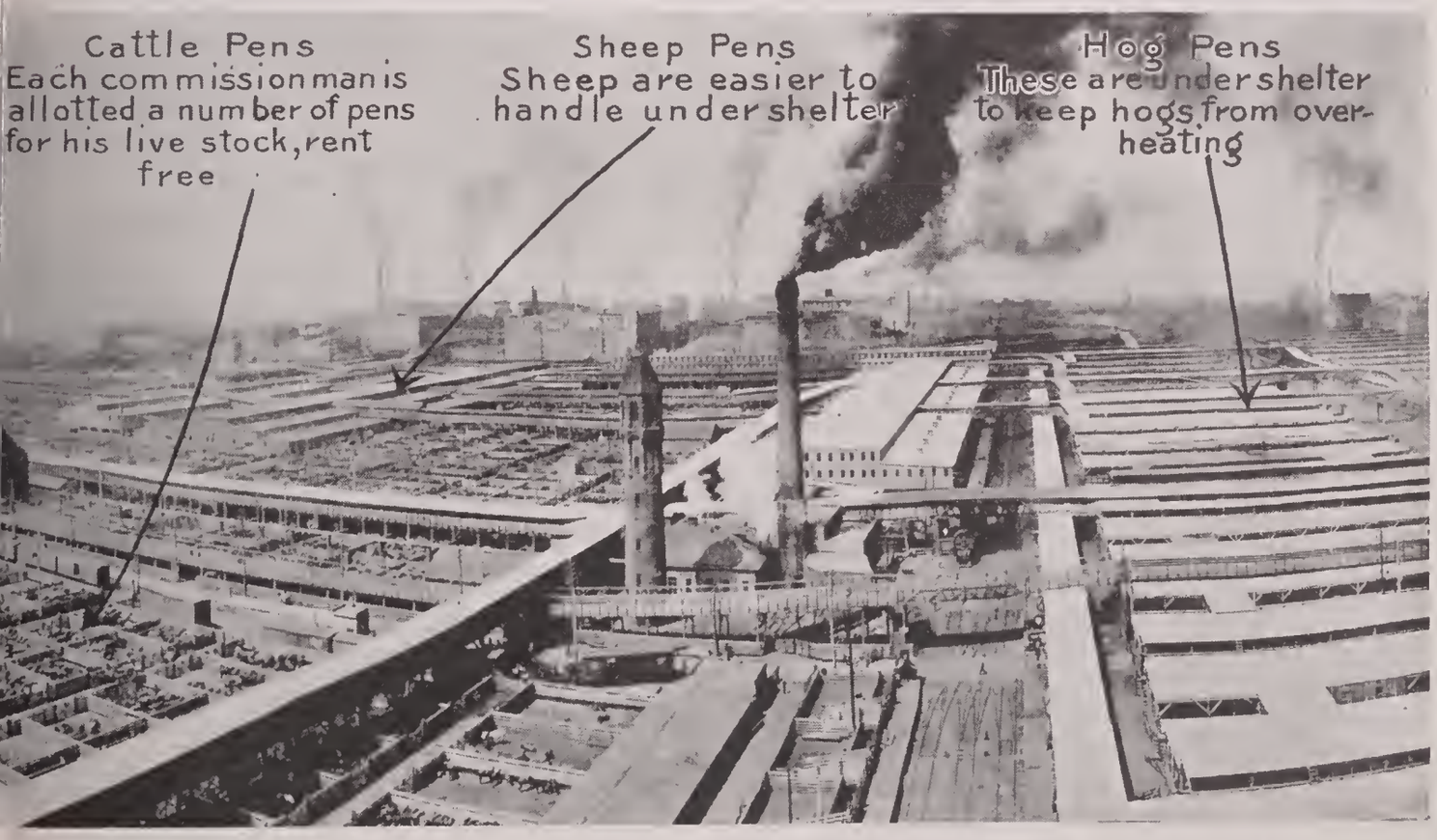
Much of this meat is cured or canned, but a great deal is shipped fresh in refrigerator cars. Many labor-saving devices are employed by the packing companies. Animals are slaughtered and dressed and the meats taken to the refrigerating rooms in surprisingly short times. A hog, for instance, is shackled to a large board wheel, dispatched, dipped in a scalding tank, beheaded, disemboweled, and dressed, all in a few minutes. Sometimes two or three hogs will be seen on the revolving wheel at the same time. Cattle are driven into the slaughter houses in a single file and killed and hoisted as they arrive. The greatest care is taken to produce the meat in a clean, wholesome, and attractive condition, and to cut each carcass so that nothing shall be wasted.

Great economies are produced by the packers' methods. Hides, hoofs, horns, bones, and entrails of the animals are all turned into useful products, thus reducing the cost of producing meats. All told, more than 400 meat products and by-products are so turned out. The bones are first cooked for tallow. Then they are ground for glue. What is left of them is used for making black pigment for painting, charcoal for bleaching, shoe blacking, filling for sheet rubber, fertilizer, sulphate of ammonia, vitrified bone for opal glass, knife handles, combs, fans, and buttons. Some of the other meat by-products are oleo oil, stearine, butterine, lard, tallow, soap, bristles, hair, bone meal, beef extract, sausage casings, essence of pepsin, and so forth. Horns, which local butchers throw away, are sold by the packers for $100 to $200 a ton. Because of the income from these "by-products" the big companies can sell meat for far less than they would have to charge if the meat had to bear all the expenses of production.

It is this economy that has urged the centralization of the packing industry into large units. According to the published reports of the largest packing company, it did a business in one year upward of 1200 million dollars; the volume of sales of the five largest companies totals slightly over 3 billion dollars yearly. These five companies together handle approximately 40 per cent of the meat production in the United States.

Inasmuch as meats are handled at retail by many dealers who also handle other food products, some of the packing companies also formerly engaged in supplying their trade with poultry, eggs, butter, cheese, canned vegetables, canned fruits, cereals, cured fish, etc. A considerable body of public sentiment, however, was opposed to the idea of the packers handling grocery commodities, mainly out of fear of possible domination of all food products. To meet this objection, as well as the objection to ownership in stockyard properties, the packers in 1919 made a formal agreement with United States Attorney General Palmer, known as the "Consent Decree," by which they agreed to discontinue certain commodities, mainly canned goods, and also to dispose of the stockyard properties within two years.

YARDS AND MEAT PACKING PLANTS IN CHICAGO



THE NEW ARRIVALS AND THE BUYERS

Each commission man doing business in the stockyards has pens like this into which cattle consigned to him are unloaded. The men on horseback who are looking them over are buyers. While most of these buyers represent the large packing companies, there are also those who buy and ship to customers in other towns, such as packers in smaller centers. Other buyers are speculators, buying when they think prices are unusually low and holding for a rise. Still other buyers are what are called "feeders" — that is to say they buy cattle that are not as fat as they should be, feed them up, and resell them.

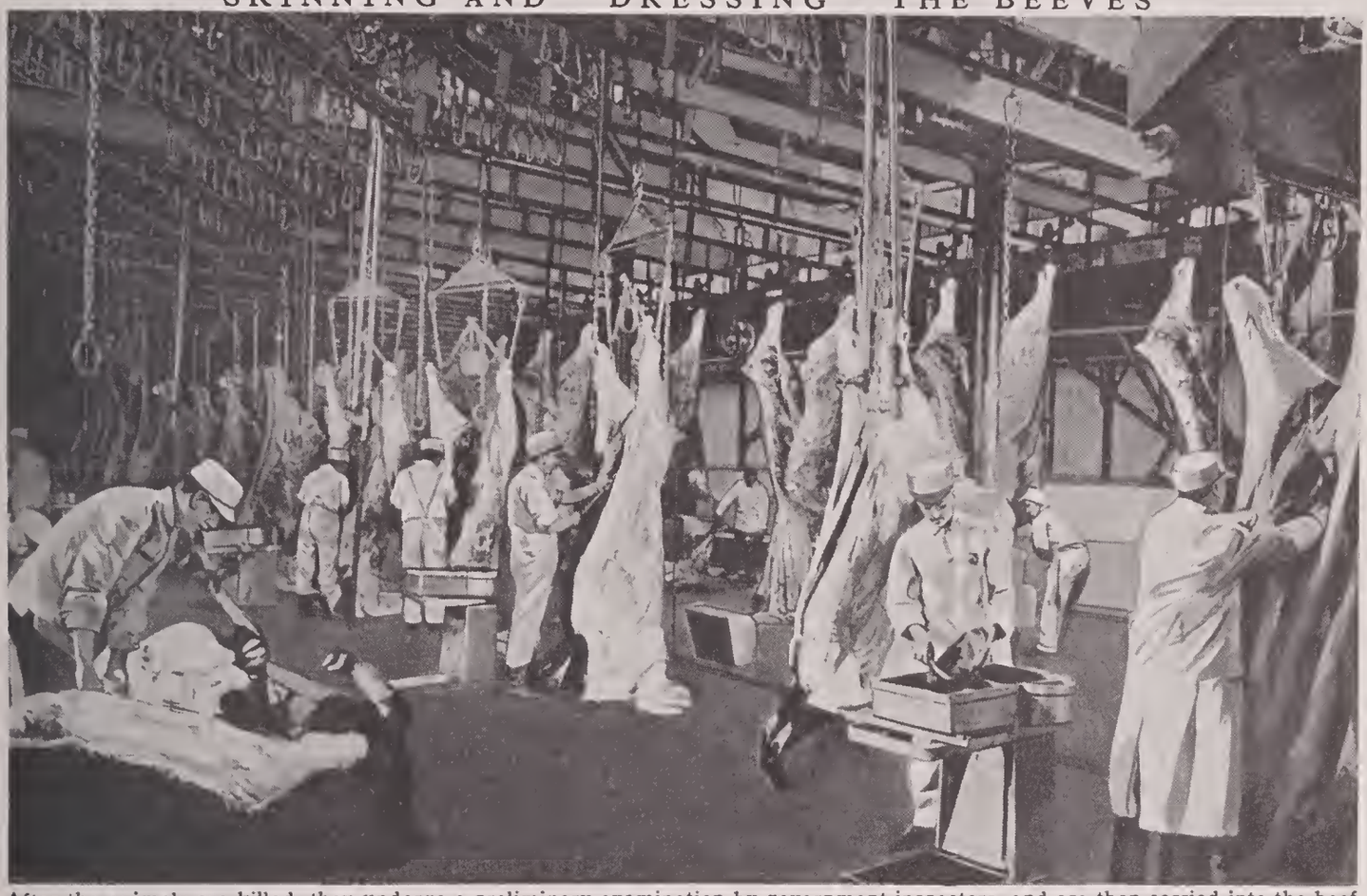
These manufacturing and selling methods not only produced profits for the packers, but helped to give us full supplies of meats at all times at fairly even prices. There is no doubt that the packers have served us by their modern and efficient methods. The meats we get are better protected against decay in the refrigerator cars and cold storage warehouses, and employment is provided for many thousands. The farmers and stockmen are also benefited, for they can sell their product any day in the year for the nation-wide market price. This "world-wide market" is perhaps the greatest advantage of all, for it sets off, for example, a shortage in Europe against a surplus in Iowa, and so keeps prices level.

The development of the great meat packing industry has been made possible by modern improvements in cold storage. At one time we thought that the best way to preserve meats was by salting, pickling, or smoking. Now we have fresh meats delivered to our tables from cold storage warehouses and refrigerator cars weeks and even months after butchering. We get just the cuts we want. If we prefer cheaper cuts, such as brisket, chuck, or round steak, the sirloin steak is shipped elsewhere. Most packing houses have their own cold storage warehouses and plants for making ice. (*See* Cold Storage; Refrigeration.)

Every care is taken by the government to see that the animals slaughtered are in a healthy condition, and that public health is protected. To this end the Federal government passed an act in 1891 requiring the stamp of its inspectors for all meats shipped in interstate commerce.

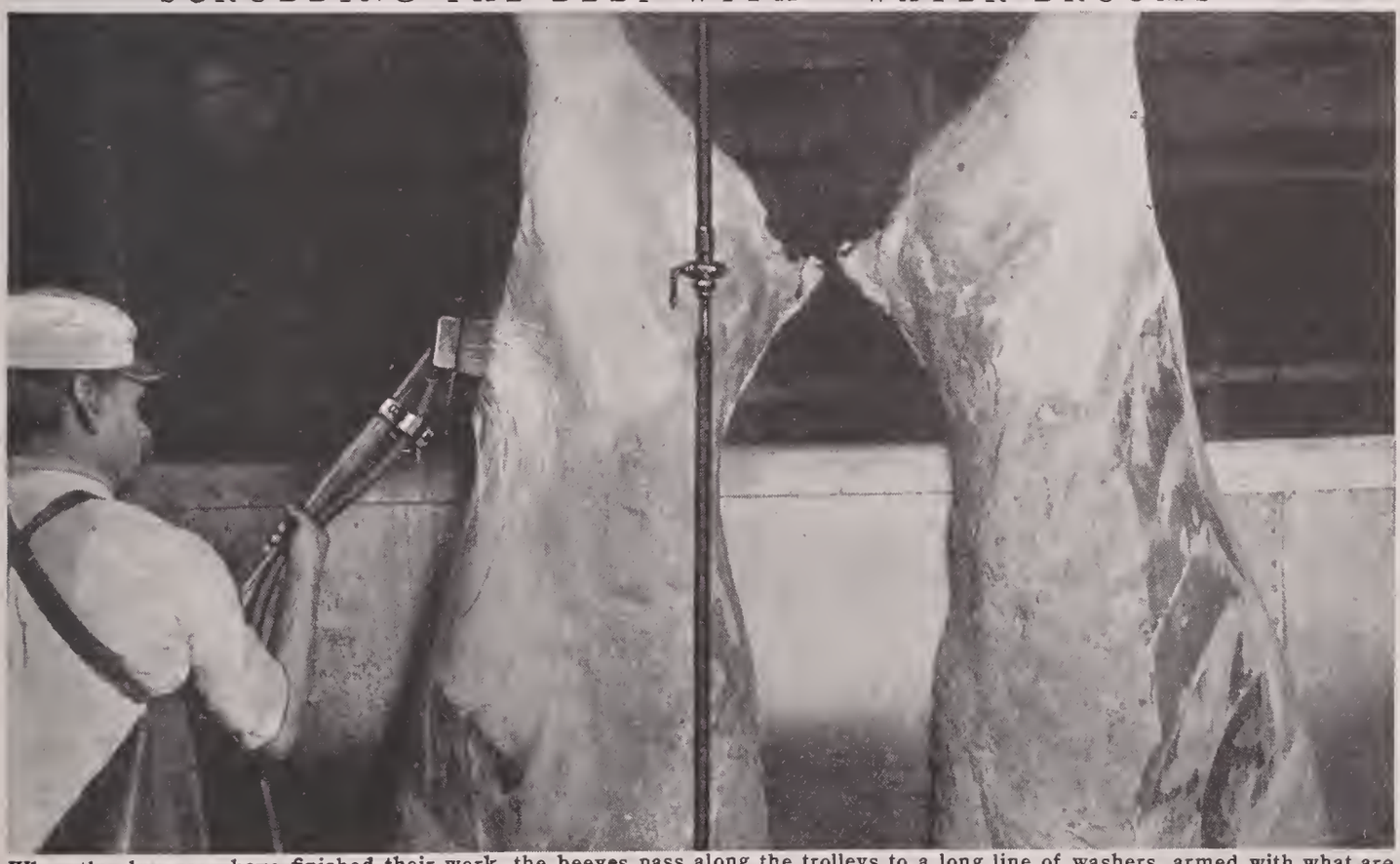
We must not suppose, however, that all the meat is handled by the big packers of Chicago, Omaha, and Kansas City. There are more than 1,200 meat packing concerns scattered over the United States. Also a great deal of beef, pork, and mutton is still slaughtered and dressed on the farms, and by local butchers in villages and small towns. Public "abattoirs" or slaughtering houses have been established in a number of cities, most of them municipally owned and operated. Coöperative packing houses have also been promoted in a number of communities. In some of the Southern states the people cure their meats at local ice houses. Surplus hogs and cattle for local consumption can be sold at these plants.

SKINNING AND "DRESSING" THE BEEVES



After the animals are killed, they undergo a preliminary examination by government inspectors, and are then carried into the beef dressing department. Here the hide is removed, and the carcasses are lifted from the floor to a system of overhead trolleys. They pass along these trolleys from one skilled workman to another, each of whom does some special portion of the work of dressing.

SCRUBBING THE BEEF WITH "WATER BROOMS"



When the dressers have finished their work, the beeves pass along the trolleys to a long line of washers, armed with what are called "fountain brushes." These clean the carcasses thoroughly before sending them to the refrigerating rooms.

FINAL EXAMINATION BY THE GOVERNMENT INSPECTOR

A government official in his clean white suit and apron is here giving the final inspection to the carcasses of hogs. Notice the electric lamp with the reflector attached to aid in the examination. All animals have four inspections. One of these takes place before it is slaughtered. After slaughtering there is a special examination of the throat glands, another of the internal organs, and then the final inspection here shown, in order to be sure that no diseased meat is sold.

THE "SIDES" OF BEEF IN THE COOLER

After passing the various tests, the carcasses are carried along on trolleys into coolers like this. Each cooler is a great room that is kept at a temperature about six degrees above freezing. This temperature chills, but does not freeze the meat. From these coolers it is delivered to local dealers or shipped in refrigerator cars to coolers in branch houses owned by the packing companies throughout the country.

For any subject not found in its alphabetical place see information

IN THE BEEF CUTTING DEPARTMENT

Here are the butchers in their white frocks dividing the "sides" of the beef into the various cuts required by the retail trade. This also is done under government supervision and the white frocks are a part of the regulations. Only a small percent of the sides however, are cut at the plant, the great bulk being shipped out whole to be cut by the retail butchers in accordance with the demand of their trade.

THE VARIOUS CUTS OF BEEF

Everybody, of course, knows what part of the animal a round steak comes from, but do you know the other cuts? Here they are so that you can easily identify them in the butcher shop. On the right in the upper picture are shown the parts of the beef from which these cuts come. The end of the loin nearest the "round" gives sirloin steak, the middle portion tenderloin steak, and the rib end porterhouse. The real "tenderloin"—not the steak—grows inside the loin.

contained in the Easy Reference Fact-Index at the end of this work

WHEN THE PILGRIMS COME TO HOLY MECCA

Notice the hundreds of tents scattered through the city. They are set up to shelter the many devout Mohammedan pilgrims, who have come to pay homage at the shrine of the Prophet. As the pilgrims approach the city, they replace their traveling clothes with seamless wrappers, and walk in bareheaded and barefooted. The chief ceremony consists in kissing the "Black Stone" set in the wall of the Kaaba shrine, shown in the lower picture. Then they circle the shrine seven times, three times running and four times walking. Next they run up and down some of the sacred hills you see here, visit nearby holy places, and throw stones "at the devil" in the neighboring village of Mina. Once the ceremonies are complete the pilgrims acquire the honorable title of "Hajji," together with the privilege of wearing a special green turban.

Here are the pilgrims gathered about the Kaaba shrine in the courtyard of the Great Mosque. This shrine, according to legend, was built by Abraham. In one corner of it is set the "Black Stone," supposed to have been given by the angel Gabriel to Abraham. The Kaaba here is covered with black brocade, which is always brought from Cairo as a gift from the Prophet's Egyptian followers. It is toward the Kaaba that all faithful Mohammedans in all parts of the world are supposed to turn at prayer time.

For any subject not found in its alphabetical place see information

Mecca, Arabia. From the days of Mohammed to the World War of 1914–18, no Christian is known to have openly entered this holy city of Islam and returned to tell the story. Those who did are the handful of adventurous men who went there in disguise or protected by a temporary profession of Mohammedanism. But these few who succeeded in the attempt saw one of the most remarkable sights in the world. For hundreds of thousands of pilgrims from the whole Mohammedan world converge on Mecca in the 12th month of every Mohammedan year, on the sacred journey that every believer is enjoined to make at least once in his lifetime to the birthplace of the prophet.

Through the Suez Canal come the Egyptians bearing their gift of a costly black brocade for the sacred Kaaba, the cube-shaped stone sanctuary in the court of the mosque. Around by the Indian Ocean come the faithful from Java, India, Persia, and Zanzibar, who disembark at the Red Sea port of Jidda and join the slow camel caravans across the 45 miles between the coast and Mecca. Other caravans make the still longer progress down from Bagdad and Damascus, the wealthy pilgrims on camels, the poor on foot; the whole line advancing at the rate of about two miles an hour, camping and cooking in the open, and always in danger from the robber Bedouins. Of late years, however, many have used the Hejaz railway from Damascus.

The "forbidden city" lies hidden among barren hills in a valley where nothing grows. The sun glares down upon it, there is never a breeze, and the rains which sweep down from the hills once or twice a year often amount to cloudbursts that sweep away houses and damage the holy buildings. Photographs show that it is a city of rather European-looking dark stone houses, three to five stories high, built along streets that all slope to the Great Mosque—an immense open court surrounded by a colonnade—containing the windowless black-veiled Kaaba, the pulpit, and the sacred well of Zem-Zem.

Long before Mecca appears around a bend in the mountains, the pilgrim puts on two thin white seamless garments that protect him neither from the cold nor from the sun. He wears these until after he has kissed the sacred black stone that is built into the southeastern corner of the Kaaba, and performed the other intricate ceremonies which occupy the next few days and reach their climax in a pilgrimage out to Mount Arafat, a half-day's journey away. Here the pilgrim takes his stand at noon of the ninth day of the pilgrimage month and recites prayers and texts till sunset—the most important ceremony of the whole pilgrimage, and the one which alone entitles him to the coveted title of *Hajji* ("pilgrim") for the rest of his life. At Mina, on the journey from Arafat back to Mecca, the pilgrims sacrifice an animal, throw stones at three sacred cairns, and then shave their heads and cut their nails for the first time since they set out on the pilgrimage. Every step of this sacred journey is attended by danger. Thousands die each year from hardship, or are killed by bandits, or are smitten by cholera and other epidemics that sweep through the multitudes as they crawl along the roads and stand closely packed on the sides of Arafat or in the inclosure about the Kaaba.

Mecca was a place of pilgrimage long before Mohammedanism. When Mohammed was born, in 570 A.D., it was a commercial town of some importance, lying on the ancient incense route from southern Arabia. It was also the center for a cult then widespread in Arabia; and the Kaaba with its black stone fetish, supposed to be as old as the world, was surrounded by 360 idols, one for each day of the ancient Arabian year. Mohammed kept the tradition and many of the ancient rites while doing away with the idols. He invented a legend which attributes to Abraham the building of the first Kaaba, and affirms that the black stone (of meteoric origin) came from Paradise with Adam and Eve.

Mecca was formerly under nominal Turkish control, but during the World War the vilayet of Hejaz in which it lies claimed the status of an independent kingdom, with the "grand sherif" of Mecca as its king. The British government guarantees protection of the Holy Places. Population, about 80,000.

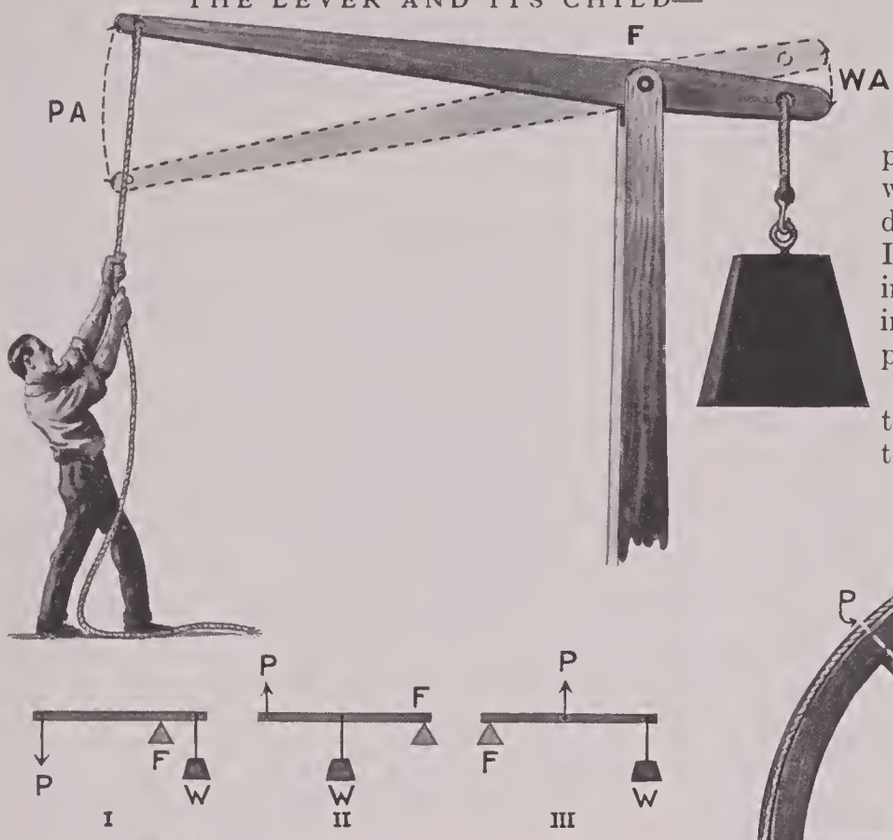
SIX PRINCIPLES *that Rule* ALL MACHINES

The Simple Laws that Tell How Much Work Machines Will Do—Labor-Saving Devices Based Upon the Lever and the Inclined Plane—The Three Great Laws Discovered by Newton

Mechanics. Probably by the time men had begun to walk on two feet instead of four they had also begun to increase the efficiency of their hands by the use of rude machines or tools embodying mechanical principles. Having learned to grasp sticks, they no doubt found accidentally that these sticks could be used as *levers* to move stones too heavy for unaided human strength to lift. It was easier to drag the killed game home up the sloping side of a hill than to pull it straight up over the face of a precipice; and some prehistoric inventor found that he could secure the advantages of an *inclined plane* by means of long smooth poles laid to slope from the mouth of his cave in the steep rock down to the level ground at its foot. When men found that sharp-edged stones would split wood and bone, they had discovered the principle of the *wedge*, which they presently turned to account in making axes, knives, arrowheads, and bodkins. A more deliberate ingenuity must have gone to the invention of the *wheel*

and *axle*, the *pulley* and the *screw:* but these six simple machines (the lever, the inclined plane, the wedge, the wheel and axle, the pulley, and the screw) had all been invented before the dawn of history.

THE LEVER AND ITS CHILD—



How can a man lift a 300-pound weight with a 100-pound pull? He can do it with a lever, provided the end he pulls is at least three times as long, and therefore moves three times as far, as the end which supports the weight. In the picture the distance moved by the "power arm" is indicated by PA; the distance moved by the "weight arm" by WA; and the fulcrum or point of support by F. According to the law of the lever, *power multiplied by power arm equals weight multiplied by weight arm.* Below the picture are the three kinds of levers: First Class (I), in which the fulcrum is between the power and the weight; Second Class (II), in which the weight is between the power and the fulcrum; and Third Class (III), in which the power is between the weight and the fulcrum. In the latter, we must imagine the lever as being fastened down to the fulcrum. In the Third Class levers, the power must be greater than the weight, for the weight moves through the greater distance.

We use them every day, both in the simple form and as elements in the most complicated mechanical devices such as the steam engine, the automobile, and the power printing press.

Archimedes first enunciated the principle of the lever—a rigid bar free to move about a fixed point called the fulcrum, used to raise a weight or to overcome resistance, which permits the power to count for more the farther it is from the fulcrum, the resistance remaining in the same place (*see* Archimedes). The auto jack, by means of which a child can raise one end of a car weighing a ton or more, the child's seesaw, and the crowbar are familiar examples; shears, tongs, and nutcrackers are double levers. Almost all locks are constructed on the lever-action principle.

The Egyptians are said to have used the inclined plane in building the Pyramids, and draymen now use it in the skids with which they load heavy barrels into wagons. The wedge is a double inclined plane at the back of which power is applied, and we use it in knives, axes, chisels, etc.

The wheel and axle, turning together about their center, form mechanically merely a special form of the lever; a small power applied to the rim of the wheel will balance a comparatively large weight depending from or pulling on the axle. Its applications are endless, as, for example, in the capstan, the windlass, and the innumerable combinations for transmitting power by toothed wheels.

The pulley, a wheel with a rim grooved to keep the cord from slipping off, is used to produce balance, as in balancing a window-sash against a weight, or to change the direction of force exerted, as when a bucket or dumb waiter or elevator is raised by pulling down; but its most important use is to multiply mechanical advantage,

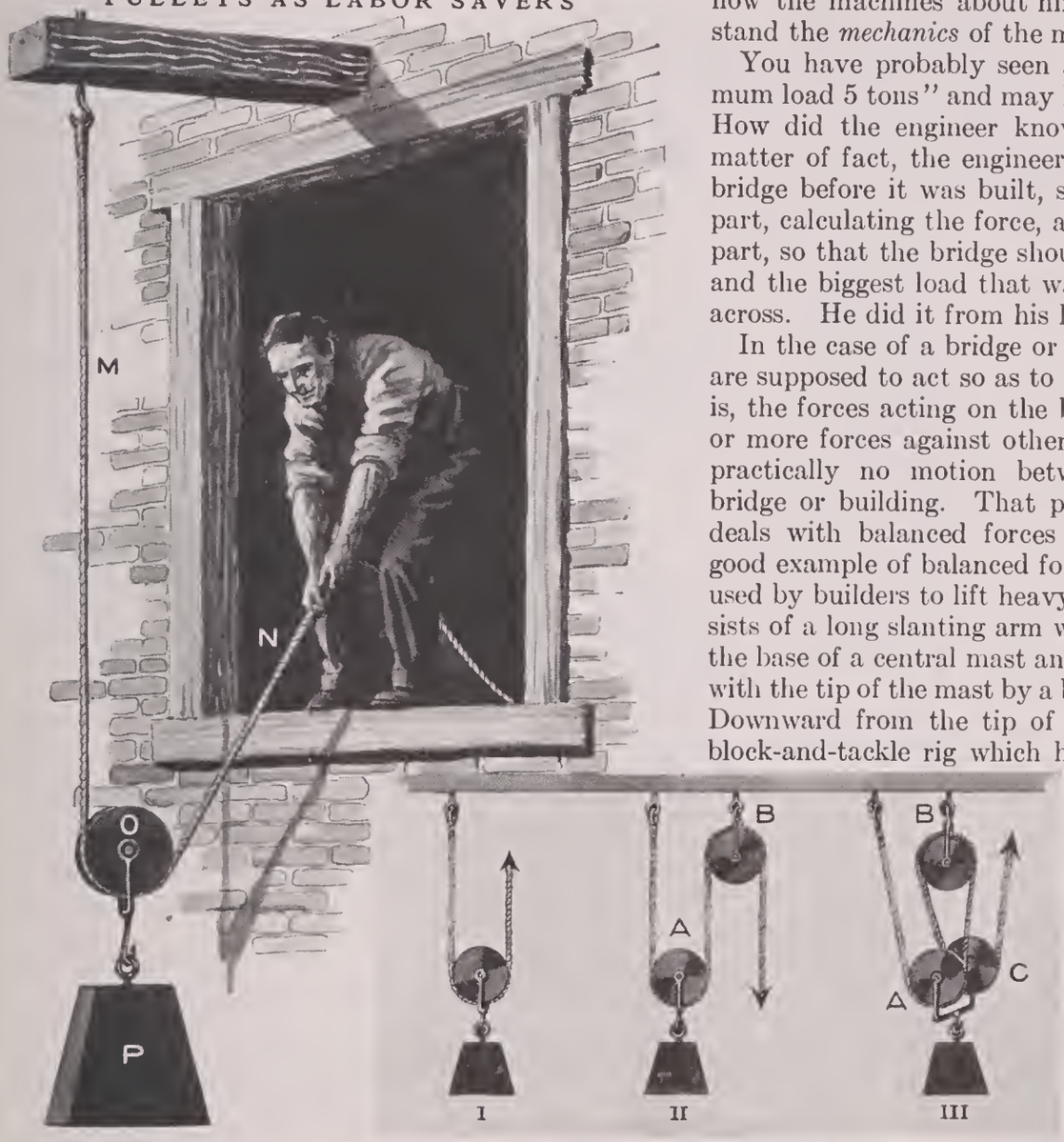
THE WHEEL

The wheel, or "wheel and drum," as the arrangement shown here is called, is an application of the lever principle. You can see at once how the axle of the wheel is nothing more than a permanent fulcrum, around which revolve continuous lever arms, represented by the wheel rims and spokes. In this case the power arm is measured by the distance CP, while the weight arm is measured by CW. Among the advantages of the wheel over the plain lever is the fact that it can be made to operate through much greater distances, and the fact that power may be applied to the fulcrum (axle) as in the case of the driving wheels of engines and motors.

as in the combination of fixed and movable pulleys used in hoisting tackle, cranes, derricks, etc.

The screw is an inclined plane twisted around a cylinder, used to overcome great resistance or to exert great force, in almost as many ways as the wheel and axle. Besides the carpenter's screws and bolts, we have the screw-press and the jackscrew, by which an immense weight, such as a house, may be raised by a comparatively small force.

PULLEYS AS LABOR SAVERS



In the larger picture the weight (P) is supported by the two ends of the rope (M and N) passing through a "moving" pulley (O). The man only has to pull against one-half the total weight for the overhead beam and its rope (M) supports the other half. However, to raise the weight he must pull in twice as much rope as he would if he lifted it directly, for he must shorten two ropes instead of one. This simple type of pulley is also shown in the diagram (I). The "fixed pulley" (B) in the next set (II) merely changes the direction of pull without multiplying the power, because the downward pull is not acting directly upon the moving or weight pulley (A). In Figure III there are four supporting strands acting directly on the weight through the moving pulleys (A and C), so in such an arrangement a given pull will move a weight four times as great. There is of course a corresponding loss in the space traveled by the weight. The fixed pulley (B) simply turns the rope back to pass through the second moving pulley (C), and does not affect the working power. The law of pulleys says that "the lifting power is multiplied by the number of strands acting directly upon the moving pulleys." In the block-and-tackle rigging all the fixed and all the moving pulley wheels are incorporated in two "blocks." The result is the same as in Figure III, where the wheels are shown separate for the sake of clearness.

These are the six fundamental "machines" of mechanics, that branch of physics which treats of the action of forces on bodies. But one of the most wonderful things in nature is that the same laws of forces that are true for common machines are used to explain the most complicated occurrences in nature. Thus, to understand the action of such a complicated mechanism as an electric dynamo or an electric motor, we use the same laws that we do in explaining the lever, wheel and axle, and other simple machines. Every boy and girl should try to explain how the machines about him act, that is, to understand the *mechanics* of the machine.

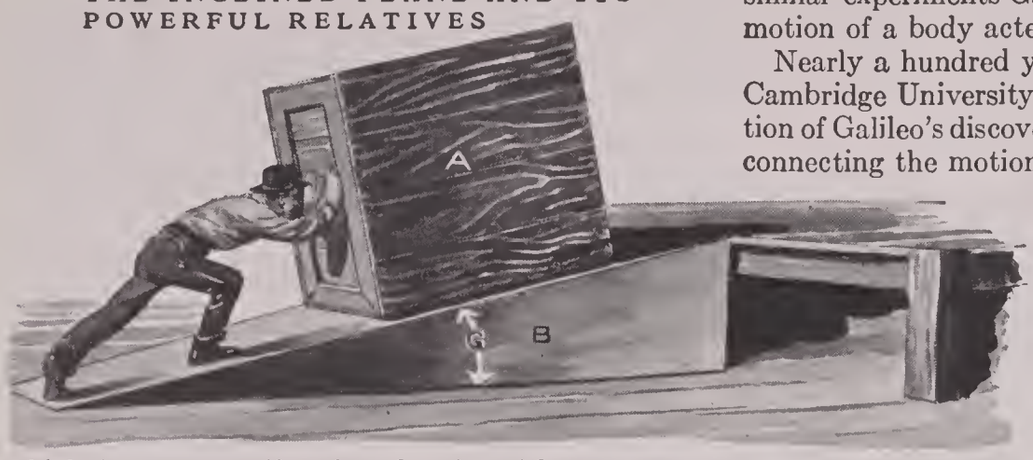
You have probably seen a bridge marked "maximum load 5 tons" and may have asked the question: How did the engineer know the safe load? As a matter of fact, the engineer made a drawing of the bridge before it was built, showing the size of each part, calculating the force, a pull or a push, on each part, so that the bridge should carry its own weight and the biggest load that was to be allowed to pass across. He did it from his knowledge of mechanics.

In the case of a bridge or of a building, the forces are supposed to act so as to produce no motion, that is, the forces acting on the bodies are balanced, one or more forces against other forces, so that there is practically no motion between the parts of the bridge or building. That part of mechanics which deals with balanced forces is called "statics." A good example of balanced forces is seen in the crane used by builders to lift heavy loads. The crane consists of a long slanting arm whose base is fastened to the base of a central mast and whose tip is connected with the tip of the mast by a block-and-tackle rigging. Downward from the tip of the arm hangs another block-and-tackle rig which handles the loads. It is essentially a combination of the lever and pulley principles, by which weights may not only be lifted but swung around to any desired position.

When a force acting on a body is not balanced there is motion of the body. In the steam engine, the unbalanced force of the steam against the piston produces the motion of the piston and this motion is transmitted to the driving shaft, and thence by belts and pulleys, or cog wheels, to some machine tool. In the locomotive, the unbalanced force through the coupling acts on the train of cars, and sets them in motion. That part of mechanics which treats of forces producing motion in bodies is called "dynamics" or "kinetics."

The simplest and most common case of an unbalanced force producing motion is that of an unsupported weight. It falls to the ground with a velocity

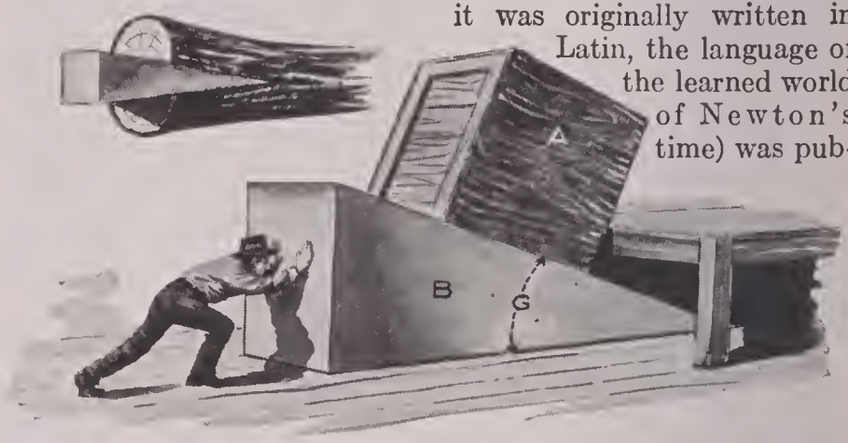
THE INCLINED PLANE AND ITS POWERFUL RELATIVES



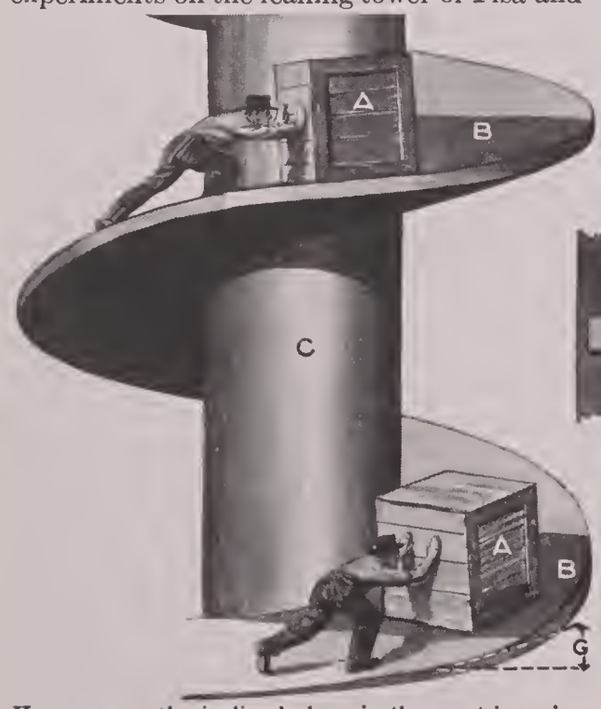
which increases uniformly; that is, with a constant increase or acceleration of speed. Starting from rest the body falls in one second 16 feet; in two seconds the distance fallen is 64 feet, or in 3 seconds 144 feet, etc. Its velocity increases 32 feet per second in each second. The force in the case of the falling body is the force of gravity or weight, that is, the attraction which the earth exerts on all bodies, the most universal and yet the most mysterious of all forces.

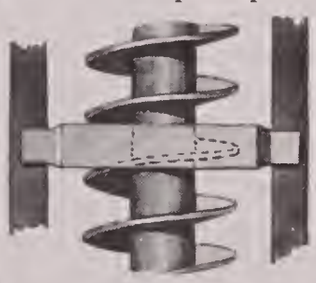
The wonderful progress which has been made in modern times in using the forces of nature to help man do his work and transport himself and his goods over the earth's surface was made possible by Galileo's studies of the most common of all motions, that of falling bodies (*see* Galileo). From his famous experiments on the leaning tower of Pisa and similar experiments Galileo discovered the law of the motion of a body acted on by a constant force.

Nearly a hundred years later Sir Isaac Newton of Cambridge University, England, as a direct continuation of Galileo's discoveries, stated the completed facts connecting the motions of bodies and the forces. It is said that Newton got his idea from watching an apple fall from a tree, thus showing that a common occurrence, when properly studied, leads to great results. Newton's great book, 'The Mathematical Principles of Natural Philosophy' (commonly called the 'Principia', from part of its Latin title, for it was originally written in Latin, the language of the learned world of Newton's time) was published in 1687. Upon its results are based all the principles and laws of modern dynamics.



Suppose a workman, who can lift 200 pounds and no more, has to raise a 400-pound box (A) to a platform. Obviously, he cannot lift it directly; but if he laid a long sloping plank—that is, an "inclined plane" (B) up to the edge of the platform, he could do the job easily, provided, of course, he got rid of excessive friction by putting rollers under the box. The principle of the inclined plane is that the smaller the angle (G) of the inclined plane, the easier it is to move the weight, although the weight must, of course, travel over a correspondingly greater distance. In the lower picture, the principle of the wedge is illustrated, which is simply our first inclined plane reversed, the sloping plane being driven under the object to be lifted.





Here we see the inclined plane in the most ingenious form of all—the screw. You remember how we showed that the wheel was simply a continuous kind of lever revolving around an axle? Well, in the same way, the screw is simply a continuous kind of inclined plane, winding around a central supporting shaft. The larger picture shows how our workman would look if he were following the thread of a giant screw. In the smaller picture we see how this principle is applied in the vise and similar tools.

In modern mechanics, we study such subjects as the forces in rotating machinery, the pressures and speeds of flowing water and of whirling air, the flow and oscillation of electrons in the electric current, the vibrations of the ether in light waves, in wireless, and in X-rays; and all these varied motions depend upon the laws of dynamics derived from Newton's famous three fundamental laws of motion. Newton's laws of motion say:

(1) Every body stays at rest, or, if in motion, continues moving uniformly in a straight line, unless acted on by an outside force. That is, matter has *inertia*.

(2) To set a body in motion, or to stop a moving body, the force required is greater, the greater the mass of the body, and also the quicker the body is started or stopped. Also the change of motion is in the direction of the acting force.

(3) To every force, there is a reaction.

Medes. In the long-ago days when the mighty Assyrian Empire was at the height of its power, there grew up on its borders, in the mountainous land southeast of the Caspian Sea, another power which steadily became more dangerous—the kingdom of Media. In contrast to the Assyrians, who were Semites, the Medes belonged to the great Indo-European family, from which we ourselves and our neighbors in Europe are descended.

Once tributary to the Assyrians, these people, simple in their habits and strong in body, had won their independence and were gaining in strength, while their former masters became weakened through wealth and luxury. At length the Medes in 606 B.C. swept down from their heights on Nineveh, the Assyrian capital, laid that splendid city in ruins, and overthrew the Assyrian Empire.

For a brief time the Medes were the greatest power in western Asia. But among their vassals were the Persians, another Indo-European people, who were, like the Medes, followers of the religion of Zoroaster and similar to them in language and customs. And now again the subject state became the ruler, for Cyrus the Great, king of Persia, about 558 B.C. seized the throne of the Median king Astyages. In course of time the two peoples were merged into one and henceforth history tells us no more of the Medes as a separate people, but of "the Medes and Persians." (*See* Persia.)

LORENZO THE MAGNIFICENT

Lorenzo de' Medici was the patron of the youthful Michelangelo, who later made this splendid statue of the Florentine leader.

Medici (*měd'ĭ-chĭ*). In the stirring days of the Renaissance many families rose to princely power over Italian cities by force of arms, intrigue, and assassination, and their heads ruled as undisguised despots. The Medici of Florence, on the other hand, the most eminent of all in their princely patronage of art and literature, rose chiefly by their wealth derived from commerce and banking and for a century concealed their absolute rule under the popular forms of a republic.

Giovanni de' Medici (died 1429) was the real founder of the wealth and power of the family. His son Cosimo (1389–1464) did a vast banking and commercial business by means of his branch houses in Rome, Venice, Geneva, Bruges, London and elsewhere; at the same time he ruled Florence through his skill in securing the election of his own creatures to the chief offices in the city. His position was not unlike that of an American party boss, who corruptly rules a city or state by all sorts of underhanded tricks and favors, without ever himself taking office. But Cosimo was a generous patron of art and literature and his palace became an asylum for Greek scholars exiled by the fall of Constantinople in 1453.

With Cosimo's grandson Lorenzo the Magnificent (1449-1492), the glory of the Medici reached its height. He escaped the fate of his younger brother Giuliano, who was stabbed to death at high mass in a church as the result of a plot of their Florentine enemies, to which Pope Sixtus IV was also a party (1478). Lorenzo continued his father's policy of disguised rule, and even excelled him in the magnificence of his partronage of men of letters and artists, including the youthful Michelangelo. Lorenzo himself was a man of learning and a poet of real originality, but his verses were often scandalous in their subjects. He was also the wisest statesman among Italian princes of his day.

Lorenzo's influence at Rome enabled him to secure the election as cardinal, at the early age of 14, of his second son Giovanni. Later this son became pope as Leo X (1513–1521), and gained fame as one of the most liberal popes in the patronage of the fine arts; in Leo's day, also, began Luther's revolt in Germany. Leo's cousin Giulio, with whom he was reared in Florence, also became pope a little later, as Clement VII (1523–1534).

The later Medici (after 1531) abandoned the forms of a republic at Florence and assumed the title of Duke of Florence. In 1537 Cosimo the Great succeeded to the duchy, annexed Siena to his domains, and received from Pope Pius V the title of Grand Duke of Tuscany. The Medici continued to rule under this title until 1737, when the family became extinct.

Catherine de' Medici (1519–1539), great-granddaughter of Lorenzo the Magnificent, became the wife of one French king (Henry II) and the mother of three others—Francis II, Charles IX, and Henry III. She was ambitious to keep undiminished for her sons the power of the French monarchy. France was torn by religious wars and in the minority of her sons Catherine intrigued now with the Catholic party, now with the Huguenots, and was chiefly responsible for the terrible St. Bartholomew's massacre of Aug. 24, 1572. (*See* Coligny, Gaspard de.)

HELPING *the* BODY *to* CURE DISEASE

How Modern Medicine Seeks to Prevent Sickness—The Folly of Treating Symptoms When the Cause of the Ailment is Unknown—What Diagnosis Means—Various Forms of Treatment—The Long History of Medicine

MEDICINE AND SURGERY. When a little girl was asked what medicine is, she said, "It is some nasty stuff that you have to take when you are sick." Now that is one meaning of the word "medicine," but it is a secondary and unimportant meaning. Medicine really means "healing." Drugs nowadays play only a small part in the treatment of disease. The sooner the little girl and all other people find that out, the better it will be for them.

Medicine is the science and art of preventing, healing, and alleviating disease.

If our knowledge of medicine were perfect, perhaps we could prevent all diseases. Even with the present knowledge thousands of lives are saved annually through the control of typhoid fever, smallpox, yellow fever, lockjaw, rabies (mad dog bite), and other diseases that used to kill many people every year.

Healing disease is more difficult than preventing it. The body really cures or attempts to cure itself. All the doctor can do is to help the body cure the disease. But this is very important, because often the body could not do it alone.

The Disease and Its Symptoms

People are often deceived about curing disease, because they confuse the symptoms with the disease itself. For example, if you have an aching tooth, which means a diseased tooth, and if you put in something that stops the pain, you do not cure the disease at all. The tooth must be properly treated by a dentist. Probably the best he can do is to stop the disease for a time by digging out the decay and filling the cavity with some protective material. This illustrates the third part of our definition of medicine, namely, "alleviation." Very often the body cannot cure the condition even with the best aid of physicians. The best that the art of medicine can accomplish in such instances is to help the person to get along with the disease and prevent it from doing more harm than is necessary.

Now if you have learned the real definition of medicine and understand the three parts of it, you can see plainly that the first thing necessary is to know which disease is present. This is called "diagnosis." To do this the doctor ought to know the cause and nature of the disease, and be familiar with all its manifestations or symptoms. Then it is necessary to know a remedy that will cure or alleviate the disease.

Each one of these three things has been very hard to find out. Mankind has only slowly learned through ages of study something of the nature of disease.

First it had to be discovered how the body is constructed (Anatomy) and how it works (Physiology). The body works as a chemical machine, so physiology has to depend on chemistry. Then men had to learn what disease does to the body—how it changes the body. This science is called Pathology. Knowledge of these sciences slowly accumulated through the ages. In the last 300 years progress has been faster.

It is only within the last 75 years that we have known much about the cause of disease. The germ diseases are the best known. These are caused by the growth in the body of very minute plants or animals. The plants are called bacteria (*see* Bacteria). Each germ disease has its own kind of germ, or rather each kind of germ causes a particular disease. The growth of these foreign organisms or parasites destroys or injures the part of the body where they locate. Often they produce poisons which go into the blood and injure distant parts of the body. These injuries, direct or indirect, are the disease. The pain, fever, weakness, etc., are caused by the disease but are not the disease itself. Pasteur, a great Frenchman, was the first to prove that certain diseases are due to germs. Now we know that diphtheria, typhoid fever, tuberculosis, and numerous others are germ diseases (*see* Germ Theory of Disease). Some diseases are due to deficiencies in diet, for example, rickets. Some are due to over-production or under-production of some natural substance in the body, for example thyroid diseases. But there are some diseases, for example, cancer, for which the cause is not yet known.

The recognition or diagnosis of the particular disease a person has is often very difficult. The doctor must have a thorough knowledge of anatomy, chemistry, physiology, and pathology. He must have had a thorough training in the signs and symptoms, which vary greatly under different conditions. He must apply various chemical tests, use the microscope, X-ray examinations, etc. Diagnosis is the most difficult branch of medicine.

You Must Find the Cause before the Cure

When the disease has been properly recognized or diagnosed, then only can it be treated with some assurance of really helping the body to cure itself. But if the disease is one whose cause is unknown, the doctor is greatly handicapped. Only in a few instances has an adequate remedy been found for disease of unknown causation. When the cause is known, however, the chances are better. In a few cases scientists have found chemicals (drugs) which will pick out and kill the germs in the body without killing the body cells, as, for example, quinine kills the germs of malaria. Such a remedy, which cures or prevents some particular disease, is called a "specific." In other cases, as diphtheria, they have found antitoxins that will neutralize or destroy the poison created in the body by the disease germs. In some diseases due to lack of some substance in the body, that substance

has been discovered and supplied. The number of specific remedies is not large, but it is slowly increasing, which is a hopeful sign for the future (*see* Drugs).

Surgery is another method of treating disease. Sometimes the diseased part may be cut away entirely. Sometimes clogged tubes, for example, the intestine, may be opened and cleaned out. Sometimes displaced parts are rearranged in their proper places. Surgery has improved wonderfully in the past 50 years. This is chiefly due to the invention of anesthetics and to the discovery of "asepsis," which merely means the carrying on of operations in such a way that no germs can enter the wounds.

Some diseases are due to wrong foods and the diet needs correction. In some diseases, like influenza or "flu," rest in bed is the best treatment known. Rest is simply giving the body a full chance to cure itself. In other diseases, not rest but exercise is needed.

The mind has an important influence over the body. Hence mental therapy is often valuable. There are, in fact, countless cases of physical disorders induced by worry, nervous strain, or mental shock, as well as purely imaginary ailments, all of which call for mental therapy. But the science of medicine makes a sharp distinction between such nervous troubles and the diseases which demand physical treatment.

Massage and manipulation of the joints are frequently valuable in establishing a better circulation of blood and lymph and therefore in helping the body to cure itself. But in other conditions they do harm. Baths, X-ray, and radium are other methods of treatment for particular conditions.

Why Doctors Differ

We see therefore that the little girl's bad "medicine" is only one of numerous ways of treating disease. All of these are parts of medicine in the true sense of the word. We see that there is only one science of medicine. All well-trained physicians use the same treatment whenever a real adequate cure has been found. For example, all kinds of doctors use antitoxin for diphtheria; all kinds of doctors set a leg when it is broken; all kinds of doctors use cylindrical lenses for astigmatism. It is only in diseases where the cause and cure are not known that doctors differ to any great extent. The reason they differ is that no one really knows in these cases whether he is helping nature or not by treatment. Each doctor thinks his treatment is good because most of his patients get well. But they would probably get well anyway.

That is the reason that so many cults or schools of medicine have flourished. Among savage tribes the chief was often "medicine man." Various rites, incantations, dances, and drumming were used to get rid of the demons that were supposed to cause disease. The sick people often got well, so they believed in the treatment. In ancient Egypt the priests of the Egyptian gods were the physicians. In Greece Aesculapius was the god of medicine. When people got well, they believed in these gods. And so it has always been, no matter how absurd the treatment.

Hippocrates, born 460 B.C., is called the father of medicine. He was the first to carefully describe symptoms and diseases. This was a great advance, but the causes of disease were still absolutely unknown. Hence various sects arose, depending on the theory of disease or treatment which was adopted. There were the "dogmatists," and "empiricals," and "methodists," and "humoralists," and "solidists," and various others in ancient and medieval times. The "allopaths" believed that remedies should be unlike the symptoms. The "homeopaths" believed that remedies should be similar to the symptoms. More recently the "osteopaths" asserted that diseases were caused by wrong adjustment of bones; and the "chiropractics," an offshoot of osteopathy, claim that disease is caused by small dislocations of vertebrae.

The New Spirit in Medicine

All these differences, so far as they are important, are differences in belief or theory in regard to diseases whose cause and cure are not yet known. As has been said, when a real specific treatment has been discovered and demonstrated, all doctors, as sensible men, use it. It is just like automobile doctoring. All mechanics will repair your car the same way when they know what the matter is. But some mechanics are better than others in finding out the trouble.

Medical students nowadays never hear anything about "allopathy" or "homeopathy" or any other "pathy." They are taught to observe, and to know at first hand the body and its ailments. They are taught that beliefs don't help you; it's what you *know* that enables you to recognize and cure disease.

If anyone should read this article and think he would like to be a doctor, let him not waste any time deciding whether he will be a "regular," or a "homeopath," or an "osteopath." Rather let him decide whether he would like the doctor's life and whether he desires to serve mankind in that capacity. If he decides in favor of being a physician, let him get the best training he can in general knowledge, and especially in the sciences that underlie body activity in health and disease. These sciences are biology, chemistry, physics, and psychology. The prospective student should study these at least two years in a good college. Then he should go to a university where good training in anatomy, physiology, bacteriology, and pathology may be obtained. He should study disease in a large hospital where all kinds of diseases are found. Such a man will recognize and treat disease as the result of observation and judgment and not because he holds some theory or belief. It will not matter either to him or to his patients what he calls himself.

MEDITERRANEAN SEA. Thousands of years ago the Mediterranean was the center of the world and its first school of navigation. Today, with Asia and Africa assuming new importance along its shores and Europe in new rivalries, the Mediterranean becomes again a center of the world's interest. In other articles

is told the story of the empires and peoples that have lived and still live on its borders. Here we can give only the chief physical facts of this largest inland sea in the world.

The Mediterranean is 2,300 miles from end to end, only 1,200 miles at its broadest from Venice to the Bay of Sidra, and 300 on an average, and at the highest estimate only 1,145,000 square miles in area. It is almost entirely inclosed by Europe on the north and northwest, Africa on the south and Asia on the east, with a narrow opening into the Atlantic at the Straits of Gibraltar and another narrow opening into the Black Sea at the Dardanelles. In summer the northeast trade-winds blow over it and in the winter the prevailing winds are westerly. Under bright blue skies, and over a dark blue sea, with fragrant land winds blowing far out over the waters from fertile shores, and with island after island almost in sight of one another to lure him on, primitive man ventured from end to end of it in boats which were probably just a hollowed log propelled by paddles.

Early History of the Mediterranean

Remains of the times before recorded history are found in a hundred places on its coasts and islands, and even past the Straits of Gibraltar. The first venturers known to history, however, were the Phoenician traders who established commercial colonies here and there along the shores and islands as far west as Cadiz in Spain. The Phoenicians were followed by their daughter colony Carthage. The Greeks colonized too, and the Sicilian tyrants sailed the Mediterranean in barges luxurious with statues and fountains. Later the sea became simply a Roman lake, and everywhere about its shores, whether in Europe, Asia, Africa or the islands, you will still find ruined temples, baths, and aqueducts, to remind you of the empire. In all times the Mediterranean has been infested by pirates as well as by peaceful traders and colonists. In our own day the submarine warfare gave Mediterranean navigators a taste of what their ancestors experienced in the Middle Ages when Christian and Saracen, Berber pirates, Genoese sailors, Spaniards, and Knights of Malta boarded one another's ships, and fought for control of the waters which in those days carried most of the world's commerce.

Various parts of the Mediterranean are known by various names, the part east of Crete as the Levantine Sea, that which separated Turkey in Europe and Greece from Turkey in Asia as the Aegean, that between the west coast of the Balkan Peninsula and Italy and Sicily as the Ionian, that between the east coast of Italy and the west coast of Turkey and Dalmatia as the Adriatic, and that between the west coast of Italy and the islands of Sardinia and Corsica as the Tyrrhenian or the Tuscan Sea. There are really only two basins, however, divided by the Italian peninsula, which nearly touches Cape Bon in Africa, with Sicily in between and a high ledge covered only a few yards deep by the sea. This barrier is a center of volcanic activity, marked by Vesuvius in Italy, Etna in Sicily, and Stromboli thundering down great balls of lava on the Lipari Islands. This subterranean seething has sometimes cast up islands almost overnight. The greatest depth in the eastern basin is 14,400 feet, south of the Morea; and in the western basin, 12,200 feet, east of Sardinia. At Gibraltar the depth is 2,500 feet and 50 miles out only 1,200. The chief islands of the western division are Sicily, Sardinia, Corsica, and the Balearic group, and in the eastern Cyprus, Rhodes, Crete, the Ionian Isles, and Malta.

Were it not for the stream flowing in from the Atlantic, the Mediterranean would no doubt dry up in a short time to a salt desert like the former seas of Asia, for the sea loses three times as much by evaporation as it gains from the few great rivers that flow into it, the Ebro, Rhone, and Po from Europe, and the Nile from Africa. From the Black Sea—replenished by several great rivers—there is also a strong current. The Suez Canal opened in 1869 connects it through the Red Sea with the Indian Ocean and restores the Mediterranean to the old place as a link in the route to India and the Far East. The Mediterranean contains 400 species of fish, about twice as many as any other sea. Sponge, tunny, and sardine fisheries are important, and divers bring up a wealth of red coral on the coasts of Provence, the Balearic Islands, Sicily, Tunis, and Tripoli.

MEERSCHAUM (*mēr'shạm*). The name of this mineral is borrowed from the German and means "sea-foam." It is a white or cream-colored claylike substance, which when dry will float on water. When first dug from the earth it is soft, like soap, and it makes a lather in water, and takes out grease; chemically it consists of hydrated magnesium silicate. In Europe it is found in Moravia, Spain, and the Crimea, and in Asia Minor there are large beds of it just below the soil. It is also found in South Carolina.

The best quality comes from Asia Minor. It is mined in blocks about a foot each way, and is carefully packed in cotton to avoid damage in shipment. Meerschaum pipes being porous absorb color from the burning tobacco and take a high polish. Vienna and Paris are the manufacturing centers.

MELBOURNE (*mĕl'bûrn*), AUSTRALIA. Inspired by tales the American "Forty-niners" told of fortunes "washed out" overnight, certain hardy young pioneers of Melbourne said to themselves: "Perhaps we too have gold in the Australian Alps, at our very back door." Within two years they found it, not more than 50 miles away; and Melbourne, capital of Victoria, Australia, only a small town then, became in ten years one of Australia's leading cities.

Reports of panning $100 to $200 a day and of finding nuggets worth thousands of dollars created tremendous excitement. "Farms, shops, ships were alike deserted, not only by the men on them but by their owners and masters. It was shearing time, but there were no shearers; it seemed probable that at harvest time there would be no reapers." Even government

IN THE CHARMING CITY ON THE YARRA RIVER

We are looking from Yarra Park across the Yarra River, toward the main business district of Melbourne. Princess Bridge is in the foreground, and the long building with the dome behind it is the Princess Bridge railway station, while to the right of the street you see running into the distance is the handsome Anglican cathedral. Yarra Park, of which you see just the beginning, contains a cricket ground, the botanical gardens, the Melbourne Observatory, and Government House.

officers and policemen deserted, and order was kept and offices manned by soldiers brought from Tasmania and from England!

Within the first nine years of their development a single group of mines near Melbourne produced $486,000,000 of gold! From the Victoria field have come 412 nuggets each weighing more than 8 pounds, 52 which weighed more than 41 pounds each, and 12 which registered more than 83 pounds on the scales! "Welcome Stranger," the hugest mass of solid gold found yet, and only one inch below the surface, was worth $50,000!

With untold wealth, then, and an assured future in sight, hustling ambitious Melbourne laid out its streets according to a carefully thought-out plan, and now claims to have as fine public buildings as any city of its size in the world. Melbourne's Town Hall has an auditorium which seats 3,000 people and houses one of the largest pipe-organs in the world. Parks and public gardens are large, numerous, and well cared for. With its manufactories, banks, deep harbor, miles of wharves, and its dry docks, Melbourne is no longer the boom town of the gold-mining rush. Business is centered within a relatively small area bounded by streets 99 feet wide feeding into parkways twice that width. The handsome residential suburbs extend for ten miles along the bay.

The province of Victoria, of which Melbourne is the capital, is the most densely settled section of Australia. Over one-half of its population lives in Melbourne, which is now a city of about 745,000 inhabitants.

MELONS. Every autumn the little town of Rocky Ford, Colo., in the center of a famous district which helps to make the United States the largest melon-growing country in the world, holds a gala "melon day." From far and near people flock there on excursion trains. They are given as many melons as they can eat or carry away, and often "championship contests" are held to determine who can eat a melon the fastest and who can eat melons in the greatest number. If you should be lucky enough to attend one of these fêtes and find an authority on melons in one of the big fields, you would learn many interesting things about this luscious fruit.

ROCKY FORD TWINS

Here are two of the luscious cantelopes which have made the Rocky Ford district in Colorado famous.

Melons, you would be told, fall into two groups—muskmelons and watermelons. The muskmelon (so named from its delightful flavor suggestive of musk) is probably a native of the subtropical parts of Asia. The Egyptians grew it, and the Israelites even before the time of Moses. The Romans and doubtless the Greeks were also familiar with it. Today its many varieties are cultivated in the temperate and warm regions of the whole world, even in half desert places like Persia. Of the many varieties the following are the most important:

Cantelope, or rock melon. This long-season variety was named from Cantalupo, Italy, where it was first

THE UNITED STATES HAS 200,000 ACRES OF THESE!

Think of 200,000 acres in the United States covered with watermelons like this every year! What bliss for the small boy lies hidden away in the luscious pulp under those hard green rinds! The states of Texas, Missouri, and Georgia are the leading producers of watermelons and reap fortunes each year from their crops.

cultivated in Europe in the 16th century. It has a hard, warty rind, often with deep lengthwise furrows. The name "cantelope" (also spelled "cantaloup") is inaccurately given to other muskmelons.

Nutmeg or *netted* melon, named from its shape. It matures sooner than the cantelope, and has a softer netted rind. The best varieties are perhaps the green-fleshed Rocky Ford; the small round heavily-ribbed Emerald Gem, with salmon-colored flesh; and the green-skinned, salmon-fleshed Osage.

Cassaba (Kassaba), or *pineapple* melon. First cultivated at Cassaba, near Smyrna in Asia Minor, this large, very sweet, relatively smooth and thin-skinned fruit, greenish yellow outside and whitish within, ripens late and keeps well in cold storage.

Honey-Dew, a large hybrid melon of exquisite flavor, very smooth and greenish white outside and deep green within; like the Cassaba, it stands shipment and storage well.

There are also such muskmelons as the so-called "snake cucumber," 2½ to 3 feet long, for preserving; the big, broad-ribbed, flattened Montreal Market, green outside and inside—an old standby near Montreal and Boston; and the very small yellow preserving variety, known by the scientific name of *chito*—also variously called orange melon, mango melon, melon apple, garden lemon, vegetable orange, etc.

The watermelon—a larger fruit with smooth dark green spotted or striped rind—is a native of tropical Africa. It has been cultivated since the earliest times in Egypt and the Orient, and was known before the Christian era in southern Europe and Asia. Its cultivation today is particularly extensive in southern Russia and the United States. In the latter country more than 200,000 acres, especially in Texas, Georgia, and Missouri, are annually devoted to its 60 varieties. The red, white, or yellow pulp of this cool, refreshing fruit, which weighs from 20 to 50 pounds and more—the record for a Georgia watermelon being 134 pounds—contains about 93 per cent water and 2 per cent sugar. The red-fleshed varieties, with light or black seeds, are the ones usually cultivated for shipment. The "citron melon" is a small, round, rather solid form of the white-fleshed variety, used for preserving. There is also a small variety about the size of an orange, pink-fleshed, called the "pomegranate melon." Among the best standard varieties are the Colorado Sweetheart, the white-seeded Alabama Sweet, the large oblong Florida Favorite, the Georgia Rattlesnake, the Spanish, the Carolina, the Black Diamond, and the Apple-Seeded.

The melon belongs to the gourd family, *Cucurbitaceae*, which includes also cucumbers, squashes, and pumpkins. It is an annual trailing or trellis-climbing vine, growing best in rich warm turfy loam, well supplied with humus. In cooler climates melons are grown in hothouses or hotbeds. Scientific name of muskmelon, *Cucumis melo;* watermelon, *Citrullus vulgaris*.

MEMNON. In Greek mythology, Memnon was the son of Eos (Aurora), goddess of the dawn, and king of the Ethiopians. He came to the aid of Troy toward the end of the Trojan War, slew Antilochus, the son of Nestor, in single combat and was himself slain by Achilles. The colossal statues of King Amenhotep III of Egypt found near Thebes were supposed by the Greeks to be sacred to Memnon. Two of these still stand. One of them, after its partial destruction by an earthquake in 27 B.C., was said to give out musical notes at sunrise. Modern travelers who have heard the sound ascribe it to the rapid passage of the air through the pores of the stone when heated by the rays of the sun. The Greeks called it the voice of Memnon hailing his mother.

MEMORIAL DAY. Each year every state in the Union sets aside a day to commemorate the services of the soldiers and sailors in the Civil War and, since 1898, of those in the Spanish American and other wars also. The custom arose from the practice in the South of decorating the graves of the Confederate dead, whence came the name "Decoration Day." Today it is observed in all states, North and South alike; and in most of the states on the same day—May 30. In many localities the day has come to be a commemoration for all dead, and graves even of those who were not soldiers are decorated with flowers and wreaths.

For any subject not found in its alphabetical place see information

MEMORY. Psychologists define memory as the knowledge of an event or fact coupled with the further knowledge that we have experienced that particular event or fact at some time in the past. In other words, your memory of having breakfast yesterday morning consists of two parts: (1) a mental picture of yourself sitting at the table, and (2) mental pictures of other events before and after breakfast, which indicate to you it happened yesterday.

Unless you actually have the mental impression of yourself sitting at the table, you haven't a true memory of the event. The mere fact that you know you *must* have had breakfast doesn't justify you in saying that you "remember" it. On the other hand, unless your image of yourself at the breakfast table is associated with other images which definitely place it in the past, then it is not a memory, but simply a detached mental image without much meaning.

Two Kinds of Memory

To understand the broad principles which govern memory we must realize also that the ability to remember depends upon two qualities of the mind. The first of these is called "retentiveness," meaning the capacity that your brain possesses of retaining an impression which it has received. The second depends upon the "associations" which that impression forms in your brain.

Take, for instance, the word "xanthocyanopia." If you, who do not know what that word means, are able to repeat it tomorrow morning, it is because a direct and virtually independent image of it has been formed in your mind, like the stamp of a seal in wax. Your ability to recall the word at will depends, then, upon the natural retentiveness of your brain matter. But if an eye specialist has occasion to use the word "xanthocyanopia," he has a good deal easier time remembering it, for he knows its *meaning*, which is another way of saying that the word is *associated* in his mind with many other familiar words and ideas. He knows, for example, that it comes from the Greek words *xanthos*, yellow, *cyanos*, blue, and *opos*, eye, and that it describes a form of color-blindness, which can distinguish no colors except yellow and blue. Every one of these details form, so to speak, a handle by which his mind can seize and pull the word out of memory's storehouse.

Improving Your Memory

Retentiveness seems to be connected in some way with the purely physical quality of the brain, and most psychologists believe that this capacity cannot be altered much for the better or the worse. If you haven't naturally a brain which holds simple impressions very firmly, there is no way of cultivating that side of memory. But, after all, the power of forming intelligent mental "associations" is far more important, and this can be acquired with practice. In fact, the whole of education is a training in this direction. Every new thing we learn gives us a new mental peg on which to hang still more ideas. If we acquire the habit of storing away each bit of knowledge in an orderly way, if we give the new idea its proper place among the old ideas, we shall have no trouble finding it when we want it. If we rely solely on pure retentiveness of memory, we may be able to repeat words or numbers like a parrot, but they will probably be without much meaning or use to us.

People may differ in the kind of memory they possess. Some have a good memory for visual images but little for sounds, and the reverse also may be true. Some remember words especially well. In teaching, therefore, it frequently is important to take account of the pupil's special powers of memory. A child, for example, may fail to respond to oral instruction because he is "eye-minded" rather than "ear-minded." If the work can be put in such a form as to appeal to the eye, it may be taken in readily.

That memory has a definite physical seat in the brain is proved by the fact that injuries to the brain either through wounds or disease are often accompanied by *amnesia* or loss of memory.

Modern psychology has rejected as artificial and ineffective the complicated systems for improving the memory which have been exploited for commercial purposes. Instead of such systems, reliance is placed upon a few simple laws which seem to govern our learning. The most important rule of learning is that repetition tends to fix an association. "Over and over again" is the best rule to follow in improving one's memory for any particular idea or act. It is better to repeat an experience too often than to fall short of learning it so that it "sticks." As a matter of fact it is necessary to "overlearn" anything that we wish to make sure of knowing later. We forget too easily to trust to learning a thing so that we can just repeat it. Tomorrow we can't repeat it, and we must learn it again.

The Need for Concentration

A second important rule is to concentrate attention upon the thing you are trying to learn. Merely to repeat an act while thinking of some very different thing is by no means so effective as repetition with concentrated attention. Most persons waste time and energy by allowing the "mind to wander" while pretending to study or work. Another good rule is to apply what you learn as soon as possible. This forces repetition and tends to correct wrong associations, and information is not worth having if we cannot use it. It is also important to be interested in what one tries to learn. Most persons learn well what they like and like what they learn well.

Pupils in school, students in college, and anyone else who makes learning a real occupation should develop a definite program of study and adhere to it day by day and week by week. Certain hours should be set aside for the study of particular subjects; there should be a definite place for study where there is a good light, good air, an even temperature, and freedom from interruptions. Each person should study himself and learn how, when, and where he can do his best work and then follow a definite schedule.

MEMPHIS, TENN. Situated on the lofty Chickasaw Bluffs in the extreme southwestern part of the state, at the head of all-the-year-round deep-water navigation on the Mississippi, Memphis is the largest city and commercial metropolis of Tennessee, and one of the most important river ports in the United States.

In the rich alluvial region surrounding it agricultural products of almost all kinds are produced in abundance. Western Tennessee, northern Mississippi and eastern Arkansas send in from 700,000 to 1,000,000 bales of cotton every year, making Memphis one of the largest inland cotton markets in the world. It also ranks first in the manufacture of cotton-seed products, including cotton-seed oil, meal, and fiber. Next in importance is lumber, Memphis being the greatest center in the United States for the production of hardwoods.

Furniture and other wood products, bags, automobile wheels, machinery, stock feeds, bakery products, and flour are manufactured in large quantities, and the wholesale drug and grocery trade is large. Railroads radiate in all directions, and 175 steamboats carry an enormous tonnage to north and south. Two massive cantilever bridges span the broad waters of the Mississippi at this point, carrying a great traffic.

Memphis is well laid out, with wide shaded streets, beautiful parks, homes, and public buildings. A beautiful parkway system encircles the city on three sides, and here is one of the largest zoölogical gardens in the country. A wide levee extends along the river front, guarding the city from danger of flood. Drinking water is supplied by a great artesian well system.

Memphis has had an interesting history. It was an ancient crossing place of the Chickasaw Indians, and it is thought that De Soto here crossed the river on his great voyage of exploration. The French erected a fort at this site near the end of the 17th century, and later another was built by the Spaniards. During most of the 18th century French and Spaniards contested for possession of this spot, but in 1797 it passed into the hands of the United States. In 1819 a permanent settlement was made, which was incorporated as a town in 1826, and granted a city charter in 1849. It was named Memphis after the famous ancient Egyptian city, because of its situation, like the city of the Nile, on a great river. During the Civil War Memphis was the scene of an important naval battle, which resulted in its capture by Union forces. The city's progress was impeded by terrible epidemics of yellow fever that ravaged it in 1855, 1867, 1873, 1878, and 1879. During the epidemics of 1878 and 1879 fully two-thirds of the population fled, business was almost paralyzed, and the city was on the verge of bankruptcy. Memphis has now established a reputation as a very healthful, progressive city. The government has been by commission since 1909. Population, about 165,000.

MEN'DELSSOHN, FELIX (1809–1847). Most great musicians have become famous in the face of handicaps, but in the case of Mendelssohn-Bartholdy (to give him his full name) there was never a day when he lacked anything that money or friends or education could supply. His parents were wealthy and cultured Jews whose home in Berlin was a meeting place for artists and scholars. At the age of four his lessons in music began, and at the age of nine he composed pieces for the family orchestra. At 15 he composed and directed a three-act opera that took his audience by storm. When soon after in London he played his 'Symphony in C' in concert, people from the audience leaped upon the stage to congratulate him.

MENDELSSOHN

The account of Mendelssohn's life is a story of pleasant and profitable work. His wonderful ability to extemporize and his willingness to play the compositions of other musicians made him a popular concert performer. His compositions were always in demand. In Germany he was idolized by all music lovers, and in other countries he was always received with acclaim.

His happy marriage duplicated the home experiences of his youth. Among the friends of his manhood were such as Jenny Lind, Robert Schumann, Hiller, Moscheles, and his own favorite sister Fanny, a musician of great merit. The University of Leipzig, to which city he had removed to direct the public concerts, conferred on him the degree of doctor of philosophy, and there he organized the famous musical conservatory of Leipzig.

No composer has enjoyed more general popularity in Germany, America, and England. The list of his compositions is long. His oratorios 'Saint Paul' and 'Elijah' are sung everywhere. His 'Hymn of Praise' is familiar to all, as is his music to 'Midsummer Night's Dream', with its much used Wedding March and nocturne; his 'Songs Without Words' are on almost every piano.

At the time of Mendelssohn's death the city of Leipzig was posted with funeral placards and the hush that fell over the city was as if a king were dead. Memorial services were held in practically every large city of Europe and America.

MERCERIZING. John Mercer, an English dealer in cloth, announced in 1844 the chemical process for making cotton cloth look like silk which today perpetuates his name. The process consists in steeping the fabric, yarn, or thread in a solution of alkali

(caustic soda or caustic potash) in a cool temperature, then putting it under tension, and lastly rinsing it. The process entails a shrinkage in bulk of about one-fourth. The cotton fibers, which were originally mere flattened spiral tubes, are drawn closer and made straight and translucent, so that they present a smooth surface that reflects the light with silklike luster. In the genuine process, which is expensive, the finish will not vanish when laundered. Cotton cloth thus treated is softer and stronger, and takes more brilliant colors in dyeing. Sometimes a variation in the caustic soda process is employed to give the modern crimped or crêpe effects.

'MERCHANT OF VENICE'. In this comedy Shakespeare portrays the magnificent womanhood of Portia against the dark, malignant power of Shylock, the Jew. Bassanio, soldier and scholar, and the "best deserving of a fair lady"; Gratiano, the madcap wit in his following; Jessica, that "most beautiful pagan, most sweet Jew," daughter of Shylock; and the "merchant of Venice" himself—Antonio "the kindest man"—form a galaxy of stars in this enthralling play. It contains, also, some of the greatest passages of Shakespeare's dramatic writing. One of these is Shylock's savage arraignment of his persecutors:

> Hath not a Jew eyes? Hath not a Jew hands, organs, dimensions, senses, affections, passions? Fed with the same food, hurt with the same weapons, subject to the same diseases, healed by the same means, warmed and cooled by the same winter and summer, as a Christian is? If you prick us, do we not bleed? If you tickle us, do we not laugh? If you poison us, do we not die? And if you wrong us, shall we not revenge?

Another passage is Portia's matchless lines in reply to Shylock:

> The quality of mercy is not strained,
> It droppeth as the gentle rain from heaven
> Upon the place beneath: it is twice blest;
> It blesseth him that gives and him that takes:
> 'Tis mightiest in the mightiest: it becomes
> The throned monarch better than his crown;
> His sceptre shows the force of temporal power,
> The attribute to awe and majesty,
> Wherein doth sit the fear and dread of kings;
> But mercy is above this sceptred sway;
> It is enthroned in the hearts of kings,
> It is an attribute of God himself;
> And earthly power doth then show likest God's
> When mercy seasons justice. Therefore, Jew,
> Though justice be thy plea, consider this,
> That, in the course of justice, none of us
> Should see salvation: we do pray for mercy;
> And that same prayer doth teach us all to render
> The deeds of mercy.

MERCIER (*mĕr'syā*), DESIRÉ JOSEPH, CARDINAL (born 1851). From the beginning of the World War of 1914–18, there stood out among the inarticulate suffering people of Belgium a picturesque figure, preternaturally tall and thin, with jet-black, deep-set eyes, who wielded more power over countrymen and enemy alike than any other Belgian. His long black habit with its cardinal-red braid, the heavy gold chain and cross about his neck, the wide violet sash and black-skirted cassock, all served to emphasize the transparent whiteness of the firm face above them—thin, scholarly, ascetic, with the expression of a man who knows what he thinks and measures what he says.

Such was Cardinal Mercier, the "Voice of Belgium," who with majestic scorn and yet superb self-control called the highest authorities of Germany to account for broken promises; who aroused the indignation of the civilized world by his "Appeal to Neutrals"; and who dared to tell his people, at a time when a German ruled in the seat of King Albert, that "the sole and lawful authority in Belgium is that of our King, of our Government, of the elected representatives of the nation. This authority alone has a right to our affection, our submission." "God will save Belgium, my brethren, you cannot doubt it. Nay, rather he is saving her," was the burden of his pastoral letter on Christmas of the first terrible year. Every effort was made by the Germans to prevent his words from being heard, but these efforts were unavailing. He remained the central figure of patriotic resistance in Belgium.

Even before the war the Cardinal was a most prominent figure. He is of Franco-Belgian origin, born in a quiet hamlet near the battlefield of Waterloo on Nov. 21, 1851. As a professor of philosophy in the University of Louvain, he was known as the author of many important works on philosophy and psychology, and his science and talent were so highly appreciated that when the Archbishopric of Malines became vacant in 1906 the pope called upon Professor Mercier to fill it. A year later he was created cardinal.

Few foreign visitors have received such a warm welcome as did Cardinal Mercier when he visited America at the close of the World War. All classes paid the tribute due to one of the gentlest and most heroic figures of four years of war and oppression.

MERCURY. This is the only metallic element that is fluid at common temperatures. It is from this fact that it receives its common name "quicksilver," meaning "live" or fluid silver. The name "mercury" is given it from the fleet-footed Roman god Mercury.

Pour a little of this silvery-white metal on a piece of paper, and you will readily see how the name fits it. No matter how much you pour out, it will not spread like water but clings together in a flattened ball. If you break up this ball, the portions promptly form smaller balls. If you bring the portions near each other again they will run together and form larger balls, because they have a strong attraction for each other. Although quicksilver is a liquid, it will not wet paper, because it is much denser than paper—so dense in fact that only gold and a few of the rarer metals surpass it in specific gravity.

Heat expands mercury, and cold contracts it regularly down to its freezing point, which is about 40 degrees below zero (Fahrenheit). This explains the use of mercury in a thermometer, the range being more than 700 degrees between its boiling and freezing points. Mercury is evaporating at all times, just as water evaporates, but the vapor is invisible.

Native mercury occurs in small quantities, usually in connection with mercurial ores. These ores, of which the most important is called cinnabar, are burned in a furnace, and the sulphur which they contain passes off as sulphur dioxide (SO_2). The mercury is collected in a condensing chamber. It is then filtered through chamois-skin to purify it, and packed in 75-pound flasks for the market.

The Greeks and Phoenicians procured cinnabar from Almaden, Spain. After the discovery of America the mercury of Peru became famous. The larger part of the mercury now used in America comes from California, and most of it from one mine, called the New Almaden. Austria also has important mines of cinnabar.

Mercury readily unites with other metals to form what are called amalgams, and this property is made use of in extracting gold and silver from their ores. The amalgam of mercury and tin is used in silvering mirrors, while others are used in gilding and in filling teeth. Mercury is used largely in making instruments such as barometers and thermometers. The making of fulminate, a chemical salt indispensable as a detonating charge for cartridges and shells, is one of the most important uses of mercury. Since mercury is a good conductor of electricity it is used in certain types of battery. Sulphide of mercury (HgS), either in the form of cinnabar or artificially prepared by heating mercury with sulphur, is commonly known as vermilion, and is ground into powder for making bright red paints. Several other mercury compounds are much used as cosmetics and medicines. Mercurous chloride (HgCl), or calomel, was a favorite home remedy of our grandmothers, and is still used by physicians. The bichloride of mercury ($HgCl_2$), called corrosive sublimate, is one of the most powerful antiseptics and also one of the deadliest poisons known. Many deaths have been caused by taking the innocent-looking corrosive sublimate tablets by mistake for medicinal tablets, so they should always be labeled and kept separate.

In Roman mythology Mercury was the god of merchandise and of merchants. He was identified with the Greek god Hermes, the son of Zeus and Maia (*see* Hermes). The innermost planet of the solar system is named for him (*see* Planets).

MER'MAIDS. Even to this day some superstitious people believe in the existence of these "sea maidens," and fancy that they have seen them coming up from the deep or seated on the rocks. The mermaid is represented as a lovely woman with a human head and body ending in the scaly tail of a fish; often she combed her long beautiful hair with a comb of gold or pearl, while she held a mirror above the waves to catch her image. Many stories are told of mermaids enticing human lovers to the depths of the sea. There are also tales of their leaving their ocean home and gaining a human form and soul through marriage with a human husband; but in most cases disaster followed such a union. Mermen, the masculine counterparts of mermaids, are occasionally heard of, but they play a less important part in legend.

MESOPOTA'MIA. An almost shadeless land where the sun is grillingly hot in summer, where autumn brings stinging dust-winds, and winter downpours of rain and a sticky mud—this is modern Mesopotamia. The name comes from Greek words meaning "between the rivers," referring to the great Tigris and Euphrates which traverse it. In this land between the uplands of Persia on the east and Arabia on the west, where legend locates the Garden of Eden and which history knows as one of the seats of the world's earliest civilization, scarce a hint remains of the ancient fertility except the dusty groves of date palms here and there at the very edge of the rivers. Jackals and wild pigs are numerous in the desert. The Tigris still hums with commerce about the city of Bagdad, but dust mounds cover the great cities of 5,000 years ago, and in their place are mud-built Arab villages. The nomadic Mongols in the 13th century during one of their invasions are said to have deliberately destroyed the 5,000-year-old irrigation system out of hatred for cities and settled agricultural life and thus put an end to the region's ancient prosperity.

ON THE SHORES OF THE TIGRIS

Such lively scenes as the one at Amara shown here are characteristic of the larger towns along the Tigris River. Amara was a strategic post in the World War, and it was from there that the Turks retreated before the British advance to the famous Kut-el-Amara during Townshend's disastrous campaign of 1915-16.

Mesopotamia has four times the area of the Nile valley, and with the latter it was the first of lands to come under cultivation. Here flourished Babylonia in the south and the later warlike kingdom of Assyria in the north. From Babylonia come some of the first written records of man, and from Assyria the first known library, found at Nineveh.

Not many years ago people began wondering why, if Mesopotamia had once been so fertile, it should not be made fertile again, and the British made estimates on a vast scale for reopening the old irrigation canals. Germany attempted to develop another of the valley's ancient possibilities, its commercial importance, and sought Turkey's permission to build a railway across Asia Minor to Bagdad to supersede the slow caravans that still trafficked to and from the city of the 'Arabian Nights'. The political consequences of such a railway in German hands, had it been continued to the Persian Gulf, would have menaced India, so this project became one of the contributing causes of the World War of 1914–18. The outcome of the war wrested this region from the dominions of Turkey, and placed it, with its boundless possibilities—including the rich oil fields about the head of the Persian Gulf—under the control of the British Empire, as a mandatary of the League of Nations.

Mesopotamia had well developed canals and cities at least as early as 3000 B.C. (*see* Babylonia and Assyria). The Assyrian Empire flourished with capitals at Asshur and Nineveh from 1600 to 600 B.C. The land became a Persian province in 538 B.C. under the conquering Cyrus. In 323 Alexander the Great died at Babylon, after adding this land to his many conquests. Later Mesopotamia became a Roman province, and in 363 A.D. passed to Persia. In the 7th century it was conquered by the Arabs and remained a prosperous land until the Mongol invasions 700 years later. Tamerlane's raid in 1393 almost depopulated the city of Bagdad. The country did not pass completely into the power of the Ottoman Turks until 1638.

Mesquite (*mĕs-kēt'*, Spanish *mĕs-kē'tĕ*). In the spring and summer on the arid plains of southwestern United States the bright green foliage and the abundant fragrant flowers of the mesquite tree, or honey locust, give life and beauty to what would otherwise be dreary wastes, for it flourishes in regions too dry for any other woody plant. This it is able to do because its roots can descend great depths to water.

Its size shows where water can be found. If it is a shapely tree of ordinary height, water will be found within 40 to 50 feet of the surface of the ground; if it is only a lofty bush, the water will be deeper, from 50 to 60 feet, and if the stems extend up only about three feet above the ground, then the water is more than 60 feet below the surface, and the plant has had to devote all its strength to the building of roots.

The remarkable root of the mesquite is an important source of fuel in arid regions. The main or tap roots do not branch or grow much smaller until water is reached, so they can be dug from the ground or dragged out by oxen in pieces 15 to 20 feet long. The long pods which succeed the tiny greenish-white flowers are crowded with seeds set in a spongy layer of sweet pulp. The Mexicans and Indians dry these pods, remove the seeds, and grind them into coarse flour which is baked into nourishing and palatable cakes or *tamales*. The heavy hard wood is very durable and is much used for fence posts and house foundations. The leaves and pods make good stock feed, and the trunk yields two kinds of gum, one clear, like gum arabic, used in laundries and for mucilage and confectionery, and the other black, furnishing a useful dyestuff.

Scientific name, *Prosopis juliflora*. The mesquite ranges from southern Colorado southward through Mexico as far as Chile and southern Brazil. The growth of the stem is very slow. Trunks more than one foot in diameter are probably more than 100 years old. The name mesquite is also applied to various coarse low-growing tufted grasses of the West and Southwest.

Metals. The discovery of metals and how to work them was one of the most important steps in human history (*see* Civilization). The earliest metals that men learned to use were those which are still among the most familiar—the so-called "base" metals (copper, iron, tin, and lead), and those called the "precious" metals because of their rarity (gold and silver). With the former they made weapons and tools; the latter were used chiefly, as they are today, for ornaments and coins.

In ordinary usage, when we think of a metal we think of something having the characteristic properties of these metals which have been longest known—that is, as hard, heavy, lustrous, malleable, ductile, tenacious, and a good conductor of heat and electricity. But with the progress of modern chemistry, which classes about three-fourths of the 80-odd known elements as metals, no exact scientific definition of a metal is possible; and many of the elements considered as metals by the chemist differ widely from the common notions of a metal. The metal lithium, for example, floats on water; potassium is soft as wax; mercury is a liquid at ordinary temperatures; antimony and bismuth are brittle. The chemist requires merely that his metals meet certain chemical tests. The most important of these is that the hydroxides of metals are "bases," while the hydroxides of non-metals are "acids" (*see* Acids and Alkalies). Even this, however, is not an absolute test, since a few of the elements on the border-line are both acid-forming and base-forming.

Some metals occur free or "native" in Nature, but most of them are found in combination with other elements as "ores" (*see* Minerals). The processes of extracting metals from their ores, refining, separating, and alloying them are included in the science of *metallurgy*. In general these processes include crushing and concentrating the ores, roasting, and smelting. (*See* separate articles on the most important metals.)

METEORS AND METEORITES. On almost any clear night when there is no moon it is possible to see "shooting stars"—those objects that flash brightly across the heavens for a brief second and are gone. Actually they are not stars at all; for stars are great bodies like the sun, while "shooting stars," or meteors, as they are more properly called, are tiny bits of matter, usually smaller than a baseball. But they are traveling so fast—26 miles a second on the average—that when they strike the earth's atmosphere they grow flaming hot, and are entirely consumed as a rule before they reach a distance of more than 30 miles from the ground. There is little question that meteors are bits or particles of comets which have disintegrated or broken up.

On an average night it is not usual to observe more than a few meteors, but it is estimated that as many as 20,000,000 enter the earth's atmosphere every day. Most of these are, of course, very minute, hardly larger than a few grains of sand.

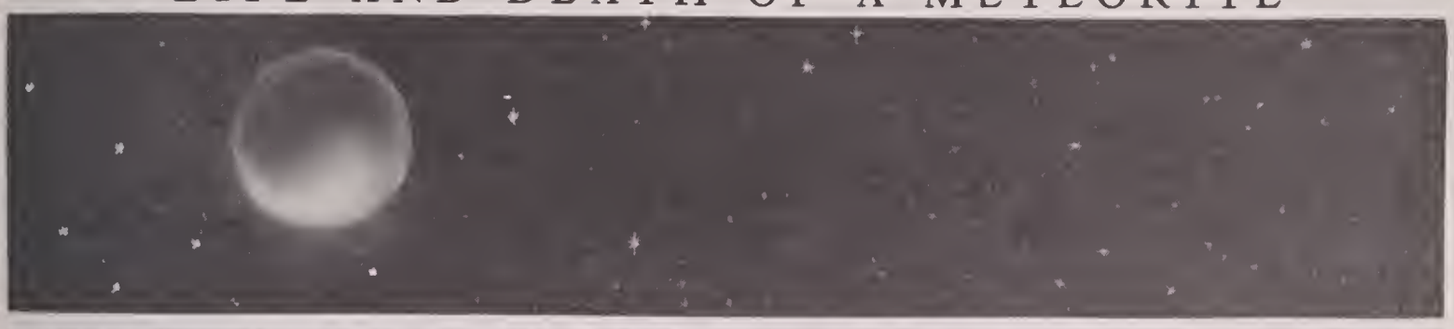
One proof of the connection between comets and meteors is that swarms of meteors travel in orbits or paths which were once occupied by comets. When the earth passes through one of these orbits we have meteoric "showers." These showers are particularly brilliant and extensive when the earth strikes one of the main swarms. This was particularly true in a group called the Leonids, through which the earth passed in 1799, 1833, and 1866. In the words of an old writer, on Nov. 12 and 13, 1833, the meteors "fell like flakes of snow, to the number, as was estimated, of 240,000 in the space of nine hours, and varying in size from a moving point or phosphorescent line to globes of the moon's diameter." This display was chiefly visible in America, and many people thought the world was coming to an end. After 1866 the attraction of some of the larger planets so changed the orbit of this meteor swarm that the shower expected in 1899 or 1900 failed almost completely, and it may never occur again.

While meteors are individually very small, it is believed that their total mass may amount to 50,000 tons in a year. Part of this is added to our atmosphere in the form of gases and part of it is probably deposited on the earth in the form of ash or small particles. In hundreds of thousands of years the size of the earth may be slightly increased by this means.

Objects similar to meteors sometimes strike the earth. These are known as *meteorites* or *aërolites*. It is possible that they are meteors which are large enough to get through the atmosphere before being burned up, but the peculiar stone and iron formations which characterize meteorites suggest that the latter may have had a different origin. They may perhaps be the remains of heavenly bodies similar to our earth which were broken to bits by some celestial accident.

A meteorite may weigh anywhere from a few pounds to several tons. In passing through the atmosphere it may roar like a railroad train, throwing off, meanwhile, numerous sparks and fragments. Sometimes it explodes. Great numbers of meteorites have been collected and placed in museums. They are mostly of a stony character, though about one in every ten is composed principally of iron. This iron is combined with nickel, cobalt, copper, etc., in a way different from any combination found on earth, but

LIFE AND DEATH OF A METEORITE



Unless it chances to encounter some other heavenly body, a meteorite will drift along quite placidly, a tiny little world lost in space (top picture). When one comes near the earth, however, it is attracted and plunges with headlong speed toward its great neighbor. The heat caused by the friction of the atmosphere ignites it, and we see it as a streak of fire (middle picture) until it is completely burned or until it hits the earth. In the latter case, its career ends in the hole it makes in the surface. (Bottom picture.)

contained in the Easy Reference Fact-Index at the end of this work

no new element has been discovered. One peculiarity of meteoric iron is a special kind of crystallization which is unknown on earth.

Armor plate was first made as a result of the knowledge gained through analysis of meteorite composition. In cutting up iron meteorites it was found that those having 90 per cent of iron and about 10 per cent of nickel were very hard and extremely difficult to slice. By mixing iron and nickel in the same proportions a steel was made which was harder and tougher than any known at that time.

A HUGE VISITOR FROM THE SKIES

This tremendous mass, weighing over 15 tons, fell to earth near Willamette, Oregon. The friction of the atmosphere set it afire, and burned the deep pits which you see in its sides during the few seconds the meteorite was passing through the air to the earth. You can imagine what a trail of fire this visitor must have left in its wake across the sky.

Meteorites have caused little damage, though it is recorded that in India a man was actually killed by one of these stones from the sky. On April 26, 1803, between 2,000 and 3,000 stones fell in France in an area of less than 30 square miles. Many have been observed and picked up in the United States. Admiral Peary, the discoverer of the North Pole, transported from Greenland a huge stone weighing 36½ tons which is thought by many to be a true meteorite. Only a guess can be made as to the number of meteorites which reach the earth in a year; it may be as few as 70 or as many as 3,000. So far as we know, these meteorites, fragments of exploded worlds, may have traveled into the solar system from the outermost depths of space. In the course of their journey towards the sun, the earth strikes across their path, and what is virtually a collision occurs.

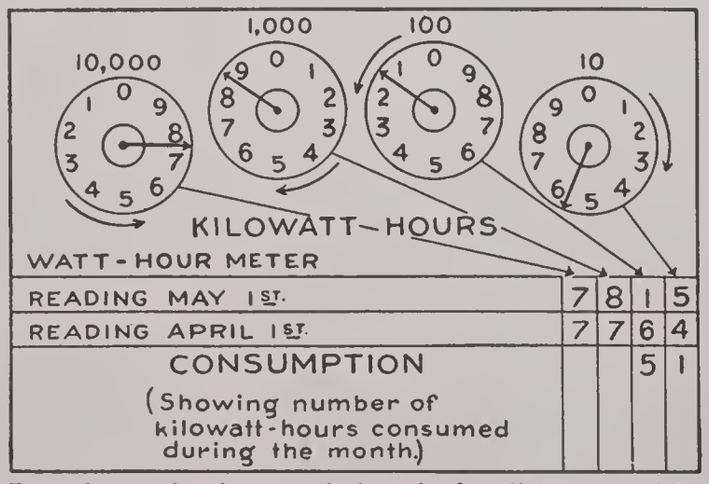
Many swarms of meteors seem to fall from a single point in the sky which is called the "radiant," and the various swarms or groups are named for the constellation in which the radiant appears to lie. Thus we have Leonids, the Perseids, the Lyrids, and the Andromedes. The Leonids are active every year in November, but other groups appear in August, April, September, and October. Planetary attraction often changes the location of the radiants.

MACHINES *that* MEASURE ELECTRICITY, GAS, *and* WATER

Devices that Keep Your Accounts with the Public Service Companies—The Little Motor that Measures the Electric Current and the Bellows that Pump up the Gas Bill—Two Types of Water Meters

METERS. In the basement of a city home you will usually find two, if not three, kinds of meters, which measure the quantities of gas, electricity, and sometimes water, used on the premises.

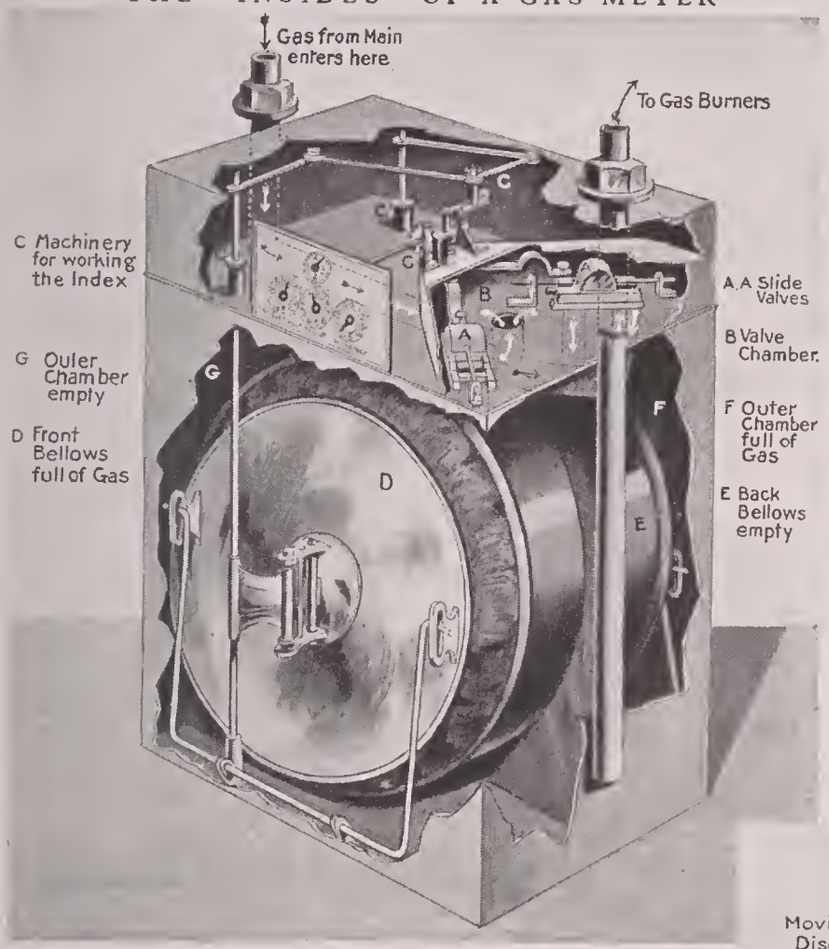
The meter in general use for measuring electric current is called a motor-meter, for it operates somewhat like a small electric motor (*see* Electric Motor). The current used by a customer passes through the meter over coils of electric magnets setting up a magnetic field of force. These forces act upon a metal cylinder or disk that is free to rotate on a pivot turning a tiny shaft, just as the shaft of an electric motor is operated by similar magnetic forces. The more current used the faster it turns, so the number of its revolutions indicated on the dials measures the amount of current passed through the meter. The cylinder is pivoted on a sapphire or diamond jewel to reduce the friction as much as possible. The wearing of this jewel point causes the meter to run slow and most electric meters tested after long service are found to run slow rather than fast—a fact which may give the customer some satisfaction. The turning shaft operates the first disk and



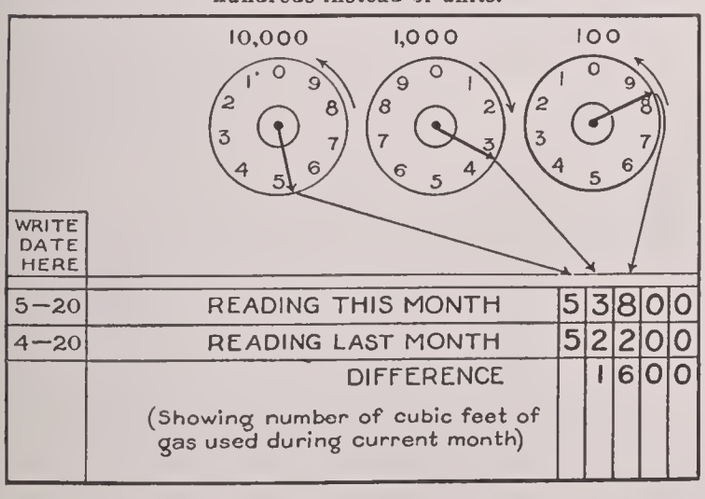
To read your electric meter, look at the first dial on the right. Set down the lower of the two figures between which the arrow is pointing (if between 9 and 0, read 9). Do the same for the other dials. Subtract from this the reading on last month's bill, and you have the number of kilowatt-hours you have used.

the cog-wheels operating all the disks are geared together in such a way that a revolution of the first disk will move the second a fraction of the distance around its dial and the second disk will move the third and so on, the disks registering in order units, tens, hundreds, and thousands of kilowatt-hours.

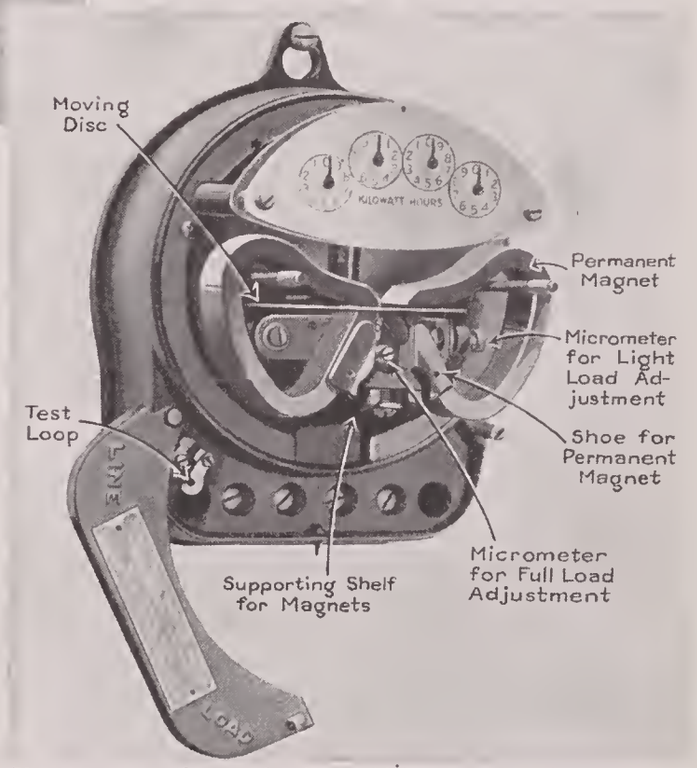
THE "INSIDES" OF A GAS METER



Gas first enters the triangular chamber (B), which is cut away to show the valves (A). The back valve (A) is open and admits gas to the back chamber (F). In this chamber is a bellows (E) with its interior connected through a valve to the pipe supplying the burners. As soon as a burner is opened, releasing gas from inside the bellows, the pressure in the chamber (F) forces the diaphragm of the bellows inward. As it moves in, it pushes out, by means of a connecting rod, the diaphragm of the front bellows (D), which now sucks in gas from the front chamber (G). This chamber, you must understand, has been filled by a previous stroke of the meter. When the back bellows has been emptied in the manner described, the back valve in the triangular chamber (B) closes, and the front valve opens, admitting gas into the chamber (G). This forces the front bellows inward, and so the pumping goes on, like a mechanical heart. The system of rods (C) records the movements of the bellows on the dials and tells you how much gas has passed through the meter. The dials, shown below, are read like those of the electric meter described on the preceding page, except that the right-hand dial shows hundreds instead of units.



The gas meter has two gas-tight chambers each having a leather bellows arrangement. The disks of the bellows are connected in such a way that when one bellows expands the other contracts. The very best grade of leather must be used in making the bellows, and it must be frequently renewed, for in order to be gas-tight it must stand a pressure as high as 200 pounds. Gas for the burners is drawn, first from inside of one bellows, then the other. The valves are so arranged that gas from the mains is supplied to the chamber surrounding the bellows which is being emptied. The pressure in the chamber squeezes gas from the bellows the chamber contains into the burners as needed. Meanwhile the other bellows is expanding. This draws in gas from the surrounding chamber, which has been filled by the previous operation of the meter. When one bellows is empty the valves shift and reverse operations. Mechanism is provided whereby the shifting of the valves operates the small drive shaft to the cog-wheels of the dials, so that the number of revolutions indicates the number of times the measure of gas in the gas-chamber has been used by the customer and the scale on the dial shows just how many 100's, 1,000's, and 10,000's of cubic feet of gas have actually passed through.



Here you see the mechanism which measures the amount of current your electric lights use every month. The current passes through electro-magnets (not visible in the picture) and rotates the horizontal disk just beneath the dials, and this disk turns the dials.

The water supply furnished to large consumers and, in some cities, to all consumers, is measured by devices which generally operate on the same principle as the gas meter. As compartments fill and empty, a shaft is turned, and dials show the number of cubic feet of water used in a given time. Another meter, especially valuable when large quantities of water are to be measured, is known as the Venturi type. This meter makes use of the fact that in a tapering pipe the pressure changes when the velocity of flow increases. The pressure, therefore, indicates the velocity; and the velocity in turn indicates the amount of water which passes in any given time. The Venturi meter is nothing but such a constricted pipe with devices which record the changing pressures at different points. Usually the record is made in terms of hundreds or thousands of gallons.

The word "meter" (from the Greek *metron*, "measure") is also applied to the basic unit of the metric system (*see* Metric System).

METRIC SYSTEM. Americans, accustomed to the easy decimal system of dollars, dimes, and cents, would feel it a bitter hardship to be compelled to go back to British pounds, shillings, and pence. Yet in the measures of weight, length, and capacity commonly used in trade (*see* Weights and Measures) there are irregularities and absurdities beside which those of the British coinage are a mere nothing.

Scientific men the world over use the decimal "metric" system for weights and measures; and many countries besides France, in which it originated, have adopted it for trade and commerce and all the purposes of daily life as well. In fact, the English-speaking countries are almost the only progressive countries which have not yet adopted the metric system for all purposes.

The metric system is so simple that it has been said that a man cast on a desert island with a cubic centimeter measure (two-fifths of an inch each way) graduated in millimeters could with it reconstruct all the measures of length, capacity and weight, and measure with scientific accuracy everything on the island, from the length of a bee's wing to the height of the mountains and the area of the island itself.

The fundamental metric unit of length is the *meter*, which is a little more than a yard (39.37 inches). Dividing the meter by 10, 100, and 1,000 gives the smaller units, distinguished by the Latin prefixes *deci-*, *centi-*, *and milli-;* multiplying by the same numbers gives the larger units, distinguished by the Greek prefixes *deka-*, *hekto-*, and *kilo-*, as in this table:

10 millimeters (mm.)	=	1 centimeter (cm.)
10 centimeters	=	1 decimeter (dm.)
10 decimeters	=	1 meter (m.)
10 meters	=	1 dekameter
10 dekameters	=	1 hektometer
10 hektometers	=	1 kilometer (km.)

The units most used in actual measurements of length are the *millimeter* (about $\frac{1}{25}$ inch), the *centimeter* (about $\frac{2}{5}$ inch), the *meter*, and the *kilometer* (about $\frac{3}{5}$ mile—3,048 feet, to be exact).

In surface measure the most common unit is the *hectare* (10,000 square meters), equal to 2.471 acres.

A hollow cube measuring 10 *centimeters* on each edge would hold 1 *liter*, the basic unit of capacity in the metric system. It is about equal to 1 quart—a little more than our liquid quart and a little less than our dry quart. It is divided and multiplied to make the smaller and larger units, respectively, as is the meter:

10 milliliters (ml.)	=	1 centiliter (cl.)
10 centiliters	=	1 deciliter (dl.)
10 deciliters	=	1 liter (l.)
10 liters	=	1 dekaliter
10 dekaliters	=	1 hektoliter (hl.)
10 hektoliters	=	1 kiloliter

The cubic capacity of a liter, it will be seen, is 1,000 cubic centimeters. The liter and the *hektoliter* are the units in this table chiefly employed. Dry and liquid measures are identical in the metric system; but where the metric system is employed in commerce there is the same tendency to buy and sell by weight instead of dry measure.

One *milliliter* of pure water weighs 1 gram, the basic metric unit of weight. Multiplied and divided for larger and smaller units, it gives:

10 milligrams (mg.)	=	1 centigram (cg.)
10 centigrams	=	1 decigram (dg.)
10 decigrams	=	1 gram (g.)
10 grams	=	1 dekagram
10 dekagrams	=	1 hektogram
10 hektograms	=	1 kilogram (kg.)
10 kilograms	=	1 myriagram
10 myriagrams	=	1 quintal (q.)
10 quintals	=	1 metric ton

The *milligram* and *centigram* are chiefly used in exact scientific work. The units most used in the ordinary transactions of life are the gram, a little more than $\frac{1}{30}$ ounce; the *kilogram*, a little more than 2 pounds (2.2046 pounds avoirdupois); the *quintal*, about 220 pounds.

When the metric system was adopted by the French National Assembly, in 1791, it was decided to take as the value of the meter the ten-millionth part of the distance on the earth's surface from the pole to the Equator. It was hoped thus to have a natural and invariable standard from which all the values of the metric system could be recovered if by accident the physical standard should be lost—as has happened to the physical standards of some other systems. The original calculation, it has been found, was subject to a slight error. The international standard meter and kilogram are made of platinum-iridium and kept at the International Bureau of Weights and Measures near Paris.

METZ, FRANCE. On Nov. 10, 1918, the American armies in France were preparing a blow at the German lines, which had as one of its principal objects the isolation of the strongly fortified city of Metz, in what was then German Lorraine. But the blow was never delivered, for the next day the armistice put an end to the fighting in the World War. Eight days later the French, with flags flying, entered the city which had been taken from them 47 years before.

Metz is situated on the Moselle River and is a part of the "middle strip" which has been disputed between Germany and France almost since the days of Charlemagne. It successfully resisted a great siege by the Emperor Charles V, in 1552, and played an important part in the Napoleonic campaigns. The second famous siege of Metz occurred when Marshal Bazaine of the French army shut himself up in the city on Aug. 19, 1870, with nearly 200,000 men and remained inactive within its walls until he was compelled by lack of food to surrender to the Germans on October 27 following. At the close of the Franco-Prussian War the German general Moltke insisted that this fortress city, together with a great part of Lorraine and all Alsace, must be taken from France. France yielded, but fortified Verdun 35 miles farther west.

Next to the tremendous system of fortifications developed by the Germans, the most interesting thing about Metz are its fine Gothic cathedral (founded in 1332) and the traces of its ancient Roman aqueduct. The chief industry is the manufacture of textiles. Population, about 70,000. (*See* Alsace-Lorraine; Franco-Prussian War.)

MEUSE RIVER. This historic river of western Europe saw the first great struggle of the World War, when the invading Germans, in 1914, took Liége on its eastern bank. It likewise saw the last decisive effort of that conflict when the Americans, on Nov. 11, 1918, advanced along its western bank, taking Sedan, 75 miles to the southwest.

Rising in northeastern France, the Meuse flows north into Belgium, where it receives at Namur its chief tributary, the Sambre, almost doubling its volume. It then flows northeast across Belgium, and enters Holland, where it is called the Maas; sweeping in a great curve around to the west it joins the Waal, an arm of the Rhine, and finally reaches the North Sea, about 20 miles below Rotterdam.

A most interesting feature of the Meuse is its disappearance beneath the ground for a distance of over three miles shortly before it enters Belgium. The Meuse is in effect, though not actually, a tributary of the Rhine. The direct distance from its source to its mouths is only 230 miles, but because of its many windings it consumes 560 miles in its course. Its larger tributaries (besides the Sambre) are the Ourthe, which pours in its waters at Liége, and the Roer, which joins it in southern Holland.

The commerce of the Meuse is probably only exceeded by that of the Rhine. A series of canals in Belgium and in Holland make it navigable for 360 miles of its course, and another canal extending to the Saone has linked it with the great river system of France.

From the ancient days when its valley was furrowed with old Roman roads leading from Gaul to southern Germany and the Danube, the banks of the Meuse have bristled with strongly fortified towns. Here during the Middle Ages was the scene of many a desperate struggle between rival princes, towns, and social classes. A line of modern forts, built after the Franco-Prussian War of 1870–71, replaced these relics of an early civilization. Today the names St. Mihiel, Verdun, Sedan, Namur, and Liége—all lying on its banks in France or Belgium—suggest the great tragedy of our own day.

MEXICAN WAR. "Mexico has passed the boundary of the United States, has invaded our territory and shed American blood upon American soil. War exists, and, notwithstanding all our efforts to avoid it, exists by the act of Mexico herself." So President James K. Polk said in his message to Congress in May 1846.

But many Americans as well as all Mexicans disagreed with the President then and later. The trouble grew out of a dispute over the boundary of the new state of Texas, formerly a part of Mexico. The United States claimed on somewhat doubtful grounds that the southwest boundary of the state—and therefore of the United States, since Texas had been admitted to the Union—was the Rio Grande River. But Mexico claimed that it was the Nueces River some hundred miles to the eastward.

This dispute might have been settled amicably had it been the only trouble. But two other issues complicated the matter. In the first place many American citizens had claims against Mexico for losses of property caused by the unsettled condition of the country, and Mexico would not pay the claims; also the President wished during his administration to acquire the vast region of California, and in the campaign for his election the spirit of conquest had been skilfully inflamed by coupling the settlement of the Oregon question with the Mexican question. Polk had tried in vain to purchase California from Mexico, but that country had indignantly refused to sell its territory. And the refusal had added fuel to the flame, especially with those who wanted more land for the expansion of slavery. This last object, one which can easily be overemphasized as a cause of the war, was the one that aroused the opposition of the people of New England to the conflict. Their attitude was expressed by James Russell Lowell in the 'Biglow Papers'—

> Ez fer the war, I go agin it—
> I mean to say I kind o' du,—
> Thet is, I mean that, bein' in it,
> The best way wuz to fight it thru.

And so they voted men and money for carrying on the war.

A One-sided Conflict

In every battle in the war the American troops were victorious, though in every important engagement they were outnumbered by the Mexicans more than two to one. General Zachary Taylor with a small force was already in the disputed area when war was declared and defeated the Mexican troops at Palo Alto on May 8, 1846. Resaca de la Palma and Matamoras fell into his hands next, and then he struck boldly into the interior. After a four days' siege and a gallant resistance by the Mexicans, he entered the

city of Monterey on Sept. 24. But his most famous victory was that of Buena Vista. There on Feb. 23, 1847, his army of 4,700 men all day long successfully withstood the attack of 20,000 Mexicans under Santa Anna who, finally acknowledging a bitter defeat, withdrew from the field. It was a splendid victory for Taylor and one that ultimately made him president of the United States.

While these victories were being won in Mexico, Americans under Capt. John C. Fremont had taken possession of California (*see* California), and Gen. Stephen W. Kearney had secured New Mexico with practically no loss of life.

The Capture of Mexico City

These expeditions gained the territory that the United States wanted. But Mexico remained unyielding, and so Gen. Winfield Scott was sent down to take the capital, Mexico City. On March 27, 1847, he captured the seemingly impregnable fortress on the harbor of Vera Cruz, and so controlled the gateway to the country. On April 18, with 8,000 men, he drove 15,000 Mexicans from the pass of Cerro Gordo (meaning Big Hill) so precipitately that President Santa Anna left his wooden leg on the battlefield! One place after another fell into Scott's hands—Jalapa, Perote, Puebla, Contreras, Cherubusco, and Molina del Rey. Finally he came to the Rock of Chapultepec (Grasshopper Hill) two miles from Mexico City. The Mexicans fought heroically in defense of this ancient fortress. But their bravery could not make up for their poor equipment, incompetent officers, and lack of organization, and after a desperate struggle they were defeated. The next day, Sept. 15, the American troops entered Mexico City and the fighting was at an end.

Treaty of Peace

With Mexico prostrate, the demands of the American expansionists passed all bounds. Buchanan, then secretary of state, declared, "Destiny beckons us to hold and civilize Mexico." But President Polk was more moderate. By the treaty of Guadalupe Hidalgo, in May 1848, Mexico accepted the Rio Grande as her boundary, and in return for $15,000,000 gave to the United States the fairest of her northern provinces—California and New Mexico, which included parts of the present states of Nevada, Utah, Arizona, Colorado, and Wyoming. She was also relieved of all claims of citizens of the United States against her for loss of property. The additional territory seemed to many in the United States not an unmixed blessing, for it raised again the burning question of slavery and the application of the Missouri Compromise to the new lands. The fact that it also gave to the United States vast mineral wealth, especially gold, and a door to the Pacific Ocean and the Orient, has not blinded sober historians to other sides of this episode in the troubled relations between the United States and a weaker neighbor.

Troubled MEXICO'S WEALTH *and* POVERTY

MEXICO. "A beggar sitting on a bag of gold." Thus Alexander von Humboldt, the famous scientist, summed up Mexico in a phrase nearly a century ago. And if this phrase was true then, it is doubly true at this time, when that wondrous storehouse of nature's wealth seems on the point of emerging from the fierce internal strife which has retarded its progress for years.

Extent.—Greatest length (northwest to southeast), more than 1,900 miles; width, from 1,833 miles along the northern boundary to 134 miles at the Isthmus of Tehuantepec. Area, 767,198 square miles (including island groups off the coast). Coast-line, 1,727 miles on Gulf of Mexico and Caribbean Sea; 4,574 miles on Pacific Ocean (including Gulf of California).

Physical Features.—Mountain ranges: Eastern Sierra Madre and Western Sierra Madre (highest peaks Orizaba, about 18,250 feet and Popocatepetl, 17,782 feet); central plateau 6,000 to 9,500 feet high. Principal rivers: Rio Grande, Conchos, Sonora, Yaqui, Fuerte, Lerma, Balsas, Moctezuma, Papaloapam, Grijalva, Usumacinta. Numerous small lakes and lagoons.

Chief Products.—Petroleum; silver, gold, copper, lead, zinc, antimony, etc.; corn, cotton, wheat, sisal hemp, coffee, beans, sugar cane, tobacco, fruit; live stock; sugar and tobacco manufactures, textiles, spirits and wine.

Principal Cities.—Mexico City (capital, 472,000), Guadalajara (120,000), Puebla, Monterey, San Luis Potosi, Merida, Leon, Vera Cruz (all between 50,000 and 100,000), Tampico (36,000).

Mexico is a treasure house wherein is stored up perhaps the most enormous and diversified wealth ever bestowed by nature upon a single people in a similar area. Scientists are awed by the vast magnitude of Mexico's mineral resources. For four centuries it has supplied more than one-third of the world's silver, and the deposits have been barely scratched. The anthracite fields of Sonora rival those of Pennsylvania. The huge deposits of copper and iron ores are incredibly rich. Cattle men have found in its broad pampas a paradise of grazing land whence each year they reap millions in profits. Mexico's giant gushers of petroleum helped to drive the Allied navies in the World War of 1914–18, and are contributing very largely to the industrial development of the United States. Yet the untapped oil resources are said to be vastly greater than any yet uncovered. Ninety per cent of all the kinds of fruits grown in the world flourish in Mexico, and every variety of grain found in the United States abounds even more luxuriantly in the rich soils of that favored land. Millions of acres are densely forested with trees whose woods are the most valuable in the world for industrial purposes.

And yet, despite these prodigious natural resources, Mexico today is a laggard among the nations in culture. More than 80 per cent of the people are Indians or of mixed Indian and white blood—most of them primitive and unlettered, living in squalid poverty. Only the initiative of foreigners has revealed the marvels of wealth that lie hidden beneath the soil. Spanish oppression, political disorders, revolutions, have made half the country's history an economic and social chaos.

ONE OF THE WORLD'S RICHEST TREASURE LANDS

Mexico is a land of amazing contrasts. The country and most of its people suffer from bitter poverty in face of the fact that its hills and plains contain a store of mineral wealth—gold, silver, iron, oil—which staggers the imagination. The mass of its people are constantly on the verge of starvation, although many spots in Mexico are veritable fairy gardens of productiveness. Desert, mountain, forest, seacoast—one can find any climate and soil desired in Mexico, all awaiting the permanent establishment of peace and order for their development.

Mexico is veritably an empire in extent, its area of about 767,000 square miles being greater than that of Germany, Great Britain, and France combined. Its shape is, appropriately enough, much like that of a cornucopia, or horn of plenty. The coast line extends more than 1,700 miles on the Gulf of Mexico and nearly 5,000 miles on the Pacific.

Majestic mountains rising abruptly from the shores of the Atlantic greet the eye of the traveler entering the magnificent harbor of Vera Cruz. As a general thing, however, the surface rises gently from the east and west coasts and from the Rio Grande to the broad table-land of the interior, where most of the mining and agriculture is carried on and where most of the people live. There are no good natural harbors on the east coast, but great sums have been spent to make Tampico and Vera Cruz serve the needs of the country. Progreso is the great sisal shipping port of Yucatan.

HAPPY AND CAREFREE

Like their own smiling land of sunshine, the Mexicans are of a bright and sunny disposition. In their efforts to build up a solid and prosperous nation, the public leaders of Mexico have to combat the tendency of the people to put all their troubles off until "mañana"—tomorrow.

Excellent harbors abound on the west coast, however, among the more important being Mazatlan, Salina Cruz (the terminal of the railroad across the isthmus of Tehuantepec), Acapulco, Manzanillo, San Blas, Guaymas, and La Paz. The boundary between Mexico and the United States is 1,833 miles long, of which 1,136 miles are constituted by the Rio Grande. South of the border arise two majestic mountain ranges, in the east and the west, known as the Sierra Madre Oriental and the Sierra Madre Occidental. These mountain chains form a link of the great Cordilleran system and contain some of the grandest scenery on the American continent. Some of the highest peaks on the continent are also found in Mexico, among them being the extinct volcanoes of Popocatepetl (17,782 feet), Orizaba (18,250 feet), and Ixtaccihuatl (16,960 feet). Mount Orizaba was semi-active until late in the 16th century.

contained in the Easy Reference Fact-Index at the end of this work

AMONG THE POOR PEONS OF MEXICO

Above is a typical lower-class Mexican family. The mother makes a few pennies a day selling onions, caring for her children at the same time. The father also is probably employed at a starvation wage. To the right are representatives of the degraded Indian stock that makes up the lowest class of all.

The climate of Mexico varies widely with the elevation. Hot weather prevails generally on the coasts, with an average temperature of 77° to 82° F. As one penetrates farther into the interior, the weather becomes delightfully cool and bracing. One finally reaches the region of perpetual spring at an elevation of 3,000 to 6,000 feet, a region where extremes of heat and cold are unknown and the mercury hovers between 62° and 70° the year round. So slight is the variation of temperature that wheat and sugar cane are grown side by side. From an elevation of 6,000 feet upward extend the *tierras frias*, or cold lands, where frosts sometimes occur and the temperature averages between 59° and 63°. During the rainy season, from the middle of May to October, torrential storms drench the southern half of the republic, but the mountain ranges bordering the plateau prevent the moist winds from reaching the interior, so that nearly all the farming land requires irrigation.

One of the curious devices employed by water carriers in the small Mexican towns to transport their liquid wares from house to house.

The mountains of Mexico form one vast deposit of valuable minerals. Nearly all the famous mines of Mexico are situated on the south central plateau at an elevation of 5,500 to 9,500 feet. Silver is found in all the states, but more than half has come from Zacatecas, San Luis Potosi, and Guanajuato. The Veta Madre lode of Guanajuato, one of the richest veins ever discovered, produced $252,000,000 in silver from 1556 to 1803 and is still being profitably worked. Much lead is also found in association with the silver. Gold is found in 18 states, chiefly along the Pacific slope, but gold mining is still in its infancy. The average annual production of gold is about 6 per cent of the world's total. Pure copper is found in abundance in Guanajuato and with gold in several other places. Mexico ranks next to the United States in copper production, and is an important producer of antimony. Quicksilver, vanadium, bismuth, zinc, manganese, and graphite are among the other valuable mineral resources.

Iron is abundant in Michoacan, Jalisco, and Durango. One of the natural wonders of the Western Hemisphere is the famous Cerro de Mercado, a hill just outside the city of Durango which is from 65

to 75 per cent pure iron ore. This hill rises 640 feet above the countryside, is 4,800 feet long and 1,100 feet wide. Engineers estimate the amount of ore in sight at 500,000,000 tons. So far lack of fuel has made it impossible to dig out this tremendous wealth. Fuel is the greatest problem which industrial enterprise has had to contend with in Mexico, because the many rich coal deposits—principally the valuable anthracite fields of Sonora, Michoacan, and Oaxaca—are remote from lines of transportation.

ONE OF THE FAVORITE SPORTS OF MEXICO

Bull-fighting is as popular in Mexico as baseball is in the United States. While it is undoubtedly a very brutal spectacle, it is also extremely picturesque. A bull-fight begins with the grand entry of all the bull-fighters — the mounted *picadors* in yellow with their lances at rest, the *matadors* and *banderilleros* (dart-throwers) in their satin jackets richly embroidered in silver and gold. Each phase of the program is announced with a flourish of trumpets. In this scene the banderillero, when the bull charges, will plant those two long darts in his shoulder, stepping gracefully aside just in time amid the applause of the spectators. After several banderilleros have further infuriated the poor maddened creature, and after the men with those red cloaks have excited him to a pitch of frenzy, a trumpet call ushers in the great hero of the occasion, the *matador* or bull-killer. After a set speech, he advances, sword in hand, receives the bull's onset and pierces him to the heart.

The history of oil in Mexico makes a veritable romance. Although the presence of oil and asphalt in great quantities had been known many years, attempts on the part of Mexicans to extract this wealth failed. In 1883 wells were sunk in Tabasco near the ground where the Pearson interests of England now control rich lands, but with no results. Later a company of which Cecil Rhodes was the guiding light failed in a similar attempt. But the glimpse which the African empire builder caught of Mexico's great mineral wealth caused him to assert that "Mexico is the treasure house from which will come the gold, silver, copper and precious stones that will build the empire of tomorrow and make the future cities of the world veritable New Jerusalems."

Repeated failure of attempts to reach oil discouraged investors until 1901, when two enterprising Americans, H. L. Doheny and C. A. Canfield, began operations at Ebano, in the state of San Luis Potosi. Their first well was sunk in 1901 and within two weeks they had struck a rich gusher. Soon they were shipping 6,000 barrels a day. Doheny and Canfield then opened the Casiano district and drilled the greatest gusher the world had ever seen, known as Casiano No. 7. Second in importance to these operations were those of the Lord Cowdray (Pearson) interests, known as the Mexican Eagle Oil Company. More than 5,000,000 acres are devoted now to the oil industry, and the output is exceeded only by that of the United States. The city of Tampico sprang up within a few years from a straggling hamlet to an important commercial center, solely because of its fortunate location in the midst of the oil fields. Oil men say that vast new deposits of oil are awaiting discovery in the coast states and under the bed of the Gulf of Mexico. On the other hand, some of the biggest producing wells changed to salt water and ceased to produce oil in 1920.

A RIVER SCENE IN MEXICO

Since Mexico is a high plateau shut in by mountain barriers, it has a light rainfall and only a narrow lowland region between the plateau and the coast. Therefore most of its rivers are like this, small and unimportant streams.

There are five principal oil districts in Mexico: the Ebano, 40 miles west of Tampico; the Panuco, including the Topila region; the Huasteca, including many famous wells; the Tuxpan district, with the Furbero region, and the Tehuantepec-Tabasco district. In a single year Mexico has exported nearly 8,000,000 tons of oil, of which 84 per cent came to the United States.

Many other industries besides mining and oil are profitably pursued in Mexico. Hundreds of thousands of acres on the northern plateaus are devoted to stock raising, and hides constitute an important export to the United States. Money accumulated by the Madero family of Chihuahua from stock raising supplied the sinews of war for the overthrow of the Diaz government in 1911.

The children in the geography class are always interested in Mount Popocatepetl. It has such a funny name! This name means "Smoking Mountain," although it never smokes any more, but stands dead and white with snow, 17,782 feet above the sea.

There are a number of packing houses, several on the Pacific coast, isolated from European and American markets, but one large company with headquarters in Mexico City does an international business. Cotton milling is a great industry in Mexico and overshadows the woolen mills, since the native demand is chiefly for cotton garments.

The numerous fiber plants support a considerable rope and cordage industry. There are many soap and cottonseed-oil factories, and petroleum refining is growing steadily in importance.

The manufacture of iron and steel products, including rails and smaller agricultural implements, has also had a considerable growth centering at Monterey, in recent years. Rubber is also manufactured where the *guayule* plant grows.

For any subject not found in its alphabetical place see information

WHERE COPPER ADDS TO THE WEALTH OF THE COUNTRY

Here is one of the many great copper-smelting plants of Mexico. If peace and order could be assured and the railroads were developed, the number of such plants would multiply rapidly, for the copper deposits are immense. At present, however, foreigners are unwilling to risk the money required to build such establishments, and the disorganized state of the railroads makes it hard to bring ore and fuel together for smelting.

Mexican cigar and cigarette factories not only supply all local needs, but export manufactured tobacco and cigars to Europe and the United States. There are also many flour mills and sugar mills, and the manufacture of native drinks (*pulque*, the fermented juice of the agave or maguey plant; *mescal*, distilled from this same juice; and *aguardiente*, distilled from sugar cane) forms a large adjunct to the country's internal commerce.

Oranges, bananas, guavas, mameys, alligator pears, and custard apples are grown in abundance on Mexican plantations. Chichopoxtle, a new fruit found near Torreon, yields 25 per cent of oil of a high lubricating quality. The most important Mexican plant, however, is the agave or maguey. Fibers of the maguey are used to make paper and rope, and its huge leaves as thatch for houses (*see* Agave).

Mexico produces normally more than 100,000,000 bushels of corn annually, of which a large amount is available for export. The yield of wheat and other cereals in orderly times is large but has been seriously interfered with by revolutions. The plateau lands 6,000 to 9,000 feet above sea level are ideally adapted to wheat raising. The frijole, or Mexican bean, is grown in every state of the republic, chiefly Jalisco and Vera Cruz, and with corn forms the staple diet of the people. Cotton, sugar, rubber, tobacco, coffee, cacao, bananas, chicle, vanilla, fruits, and other southern products are grown successfully but have not entered largely into the world's trade. Timber production is growing constantly, the forests containing many rare and valuable woods, including 25 varieties of hard woods not commonly known to American lumbermen. Half the mahogany and much

THE SILVER-MADE CITY OF GUANAJUATO

This is Guanajuato, the capital of the Mexican state of that name. The principal industry of the state is mining. The mineral wealth of the mountain ranges which we see adjoining the city is enormous. The mines have yielded silver since the Spanish conquest, and one of them, the Veta Madre or "mother lode," is one of the richest in the world. The hills are honeycombed with mines, and the city has the largest silver reduction works in Mexico.

A WHOLE LAKE OF RICH OIL

Here is a real "lake of riches," for it is filled with crude petroleum from the enormous underground stores which Mexico possesses. The reservoir into which the oil is pouring from the pipe is made by scraping out a shallow pit with road scrapers. From the reservoir the oil is drawn off for shipment to the refineries or piped direct. The abundance of oil is one of the factors which is making Mexico more and more important in the world's commerce and industry.

of the ebony used in the United States come from Mexico. Logwood and other valuable dyewoods are largely exported to the United States. Huge quantities of henequen, or sisal hemp, are exported from Yucatan to the United States every year, this commerce having made Yucatan one of the richest states in Mexico. Sisal is used largely in the manufacture of binder twine for American harvesters.

A MEXICAN HEMP PLANT
One of Mexico's important products is the "sisal" hemp from this plant.

For centuries Mexico has been the cradle of wars—wars of conquest, wars of defense, civil wars. In prehistoric times one native race after another dominated the country. When the Spaniards under Cortez invaded and conquered Mexico (1519–21) they found the Aztecs in power, under Montezuma (*see* Aztecs; Cortez, Hernando). In 1810, after three centuries in which Spain ruthlessly exploited the country and mistreated the natives, Miguel Hidalgo, a parish priest, led a revolt against Spain; but he was captured and shot the following year. Others kept the flame of revolt alive, however, and the examples of the successful revolts of Spain's South American colonies was an important factor. On May 19, 1822, a Spaniard named Augustin de Iturbide proclaimed himself emperor of Mexico and independent of Spain. He was dethroned the following year by republican forces and when he returned from Italy, whither he had been deported, he was put to death. Half a century of civil war and revolution followed. For 30 years of this time the dominant figure was Gen. Antonio Lopez de Santa Anna, who had first proclaimed a republic in 1822, and who was president when Texas revolted, and again at the time of the war with the United States.

Texas won its independence from Mexico in 1836, and ten years later boundary disputes with the United States resulted in war. (*See* Mexican War.)

The rule of Santa Anna, who had recovered power and exercised it in the conservative interest, ended with his exile in 1854.

THE NATIONAL BEVERAGE OF THE MEXICANS

The national beverage of the Mexicans is "pulque," made from the juice of the agave, which oozes out and collects in the cuplike formations at the bases of the leaves. The workman sucks it up into a gourd and then empties the juice into a vessel, where it is allowed to ferment. Pulque shops, where this drink is sold, are as common in Mexico as soda fountains in the United States.

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RELICS OF AN ANCIENT RACE

The National Museum in the City of Mexico is rich in Mexican antiquities. The visitor with the broad hat is looking at the famous Calendar Stone, which you may read about in the article on Aztecs. The picture on the right shows a stone known as the "Great Turtle," richly decorated with symbols of the Aztec religion.

In 1858 a new element came to power when Benito Juarez, a full-blooded Indian who had studied law and entered politics, became president. In 1859 he issued a decree intended to separate church and state, abolish the monastic orders, and nationalize all church property; this was violently opposed by the clergy. His administration was constantly harassed by revolutions, but he was still in power when he died in 1872.

When Juarez announced a two-year suspension of payments on foreign loans in 1861, France, Great Britain, and Spain occupied Vera Cruz. Great Britain and Spain soon withdrew, but France under Emperor Napoleon III attacked and overthrew the Mexican government. In the course of the struggle the French suffered a severe defeat on May 5, 1862, whence comes the Mexican national holiday known as the Cinco de Mayo (5th of May). In 1863 France declared Mexico an empire with Maximilian I, an Austrian archduke, as emperor. The United States protested against this violation of the Monroe Doctrine, and at the close of the American Civil War France was obliged to withdraw its troops. Porfirio Diaz then captured Mexico City, in 1867, and took Maximilian prisoner. He was tried by court martial, and shot on June 19, 1867. The rifle used is still on exhibition in Monterey.

Porfirio Diaz, of mixed Spanish and Indian blood, was one of those who had headed revolutions against Juarez. In 1877 he himself secured the presidency after overthrowing Juarez's successor, and ruled until 1880, when a law forbidding reëlection until after four years had passed led to his retirement. In 1884 Diaz was reëlected, and ruled (the constitution being amended) until he was overthrown by Francisco Madero in 1911 (*see* Diaz, Porfirio).

The progress of Mexico between 1876 and 1910, while Diaz ruled as a benevolent dictator, was perhaps greater than the sum total of the progress achieved by Mexico in all the centuries of its previous history. The public debt was funded, credit abroad assured, railroads built and extended, factories erected, foreign capital brought in to aid industrial development, the gold standard adopted. Mexican national finances showed a surplus for the first time since the overthrow of Spanish rule. But all this progress was not accomplished without undeniable abuses entering the

THE GREAT CATHEDRAL OF MEXICO CITY

The foundations of this cathedral were laid in 1573 on the site of an Aztec temple which had been destroyed by Cortez a little over a half century before. It was finished in 1811 and is one of the largest places of worship in America. The general plan is that of a Greek cross with two great naves and three aisles, and twenty side chapels. Its high altar, the beauty of which is famous, is supported by marble columns.

government, particularly as the aging Diaz gradually relinquished his personal grip on public affairs. Revolution broke out in 1910 following the elections, and Francisco I. Madero, a liberal, captured the city of Juarez on May 10, 1911. He forced Diaz to resign the presidency, and was himself elected president on a platform which promised reforms in the suffrage, land distribution, freedom of the press, and the single presidential term. Almost immediately he was confronted with an insurrection headed by Felix Diaz, nephew of the dictator, and other corrupt politicians and army officers of the Diaz rule. When he overcame them he refused to execute the leaders. Then Gen. Victoriano Huerta treacherously revolted, joined hands with the former rebels, and when Madero was captured he was brutally murdered (Feb. 19, 1913) with several of his supporters.

Venustiano Carranza, a Madero adherent, immediately began a counter revolution in Coahuila, of which state he was governor. His revolt flamed rapidly to other states, and the Huerta régime was doomed. The circumstances of Madero's death stirred great hostility against Huerta in the United States. Carranza's forces, known as the Constitutionalists, won signal military successes under Francisco ("Pancho") Villa, Alvaro Obregon, and Gonzales. Huerta regained some of his popularity in his own country when he defied the power of the United States after the so-called "Tampico incident" in the spring of 1914. Sailors from the United States gunboat *Dolphin*, ashore at Tampico for supplies, were arrested by Mexican police and the flag was insulted. Admiral Mayo, backed by President Wilson, demanded an apology and a salute to the flag. Huerta apologized but refused to salute. The American fleet sailed to Mexican waters and a force of marines occupied Vera Cruz to prevent the landing of munitions for Huerta from a German steamship. Snipers killed and wounded several Americans. War seemed imminent but was averted by the mediation of the "A B C" powers (Argentina, Brazil, and Chile).

In the meantime Carranza won decisive military successes and drove Huerta from the country. Carranza and Villa quarreled and Villa became a rebel chieftain. In the summer of 1916 he raided Columbus, N.M., killing a number of Americans. President Wilson sent General Pershing into Mexico at the head of a punitive expedition, but Villa escaped.

WHERE THE PRESIDENT OF MEXICO LIVES

This is the "White House" of Mexico, the official residence of the President. It is called Chapultepec Castle and is beautifully situated on a wooded height three miles southwest of the city. A part of the castle shelters the national military school. The hill figures in American history because of the battle fought there between the Mexicans and the forces of General Scott in 1848. Chapultepec was the last strong position remaining to the city's defenders, and after a bombardment on the 12th of September, was assaulted and carried the following day. A monument to the memory of Mexican cadets who died in its defense now stands in the park. Chapultepec means "Grasshopper Hill" in English.

After the entry of the United States into the World War of 1914–18, Mexico became a center of German intrigue designed to hamper the United States and the Allies and especially to tie up the oil shipments which were indispensable to their navies. Germany even went so far as to propose, in the famous "Zimmermann note," to assist Mexico in invading the United States to recover the territory lost in the Mexican War.

That the improvement in the internal condition of Mexico with the Carranza régime was steady and marked cannot be doubted. Carranza set on foot many reforms which met with much satisfaction among the people. But the new constitution which he caused to be adopted in 1917 led to friction with the United States and other countries by its taxes on and other regulations concerning mineral and oil lands in the foreign hands. The killing of American citizens and destruction of American property in Mexico, and the obstinate and stiff-necked attitude of Carranza increased the difficulties. Finally Carranza's attempt to control the election of his successor led to a revolt in the state of Sonora early in 1920, which soon became widespread. Carranza was driven from the capital, and fled with a handful of supporters. On May 20, after having been captured, he was brutally shot. After six months under a provisional president, Alvaro Obregon was, on Sept. 5, 1920, elected president of the republic. Under the new rule a policy of internal peace and friendship with the United States was adopted, which promised to restore the prosperity which had vanished with the fall of the Diaz régime ten years before.

Mexico has been a federative republic since 1821 but its first constitution was not promulgated until 1857. The president is elected for four years. Other branches of government are the legislative and judicial. The country is divided into 27 states, three territories, and a federal district with an organization modeled upon that of the United States. Education is free and nominally compulsory, but the bulk of the people cannot read or write. The prevailing religion is Roman Catholic, but all religions are tolerated and the church is independent of the state. (*See* Diaz, Porfirio; Mexico City; Rio Grande; Vera Cruz.)

Mexico City, Mexico. The charming location of the capital of the Mexican republic makes it one of the most attractive cities in the Western Hemisphere. It lies almost midway between the east and west coasts on the great central plateau of Mexico about 7,400 feet above sea level, and 200 miles northwest of Vera Cruz, its nearest seaport on the Gulf of Mexico. To the south tower the rugged Ajusco Mountains, and to the southeast the giant snow-clad Popocatepetl and Ixtaccihuatl peaks. At the time of the Spanish conquest the city occupied part of the lake basin of Lake Texcoco, and was approached by causeways. The waters have receded, however, and now the lake lies about two miles to the east of the city. Two other lakes, Chalco and Xochimilco, separated by a narrow strip of land, lie about nine miles southward, and are connected with the lower part of the city by a canal called "La Viga," a remarkable engineering work completed in 1898. This canal serves as an outlet to the gulf for the lakes of the

vicinity, whose overflows have several times proved destructive to life and property in Mexico City. The canal also serves as a waterway for traffic in flowers and vegetables. The city's water supply is obtained from the springs of Lake Xochimilco.

Mexico City is laid out with almost unbroken regularity. On the western side are the better residence sections, and on the east, near the swampy shores of Lake Texcoco, lie the poorer districts. The buildings are low because of frequent earthquake shocks, and are built largely in the picturesque Spanish style about a central court. In the old quarter the houses are dingy and mean, while in the modern section they are almost palatial. The commercial and political center of the city is the Plaza Mayor. Facing this are the Spanish Renaissance cathedral (16th century)—one of the largest and most beautiful churches in America—the national palace, and the municipal palace. North of the national palace is the national museum, which houses an almost priceless collection of Aztec antiquities. Leading out from the public gardens (called the Alameda), the gathering place of the fashion and aristocracy of the capital, is the magnificent boulevard Paseo de la Reforma.

The climate is temperate, dry, and healthful. The wet season occurs from April to September, though the rainfall is not abundant. The death rate is high, due partially to the crowded conditions in which the natives live. The completion in 1900 of an extensive sewerage and drainage system has helped considerably in decreasing the annual number of deaths, but epidemics among the poorer classes still take a heavy toll.

The industries are of little importance, though the development of electric power within recent years has helped manufacturing. Among the leading products are textiles, leather, boots and shoes, paper, pottery, tobacco, soap, liquor, flour, and furniture.

Mexico City was founded about 1325 by the Aztecs, who built a village of mud and rush dwellings on little islets in Lake Texcoco and called it Mexitli in honor of their god of war. It grew rapidly with the increasing power and civilization of the inhabitants, and in the 15th century the rude dwellings were replaced by stone structures. The town had reached the height of its glory when, in 1519, the Spaniards under Cortez appeared and practically destroyed it. It was rebuilt by natives under the direction of the conqueror. In the Mexican War of 1846–48, it was captured by the United States troops under General Winfield Scott, and was held until the signing of the armistice. Population, about 472,000.

IN THE HEART OF MEXICO CITY

The Plaza Mayor or Plaza de la Constitucion is the political and commercial center of the city. Stretching out in front of the great cathedral, it is one of the most imposing squares in the world. Its broad face is set out in formal gardens with wide walks between. The National and Municipal Palaces face it. The National Palace covers nearly ten acres and contains the executive offices of the government, the Senate Chamber, the National Museum, and the Weather Bureau. Over its main gateway is the "Liberty Bell" of Mexico which was first rung by Hidalgo, and at midnight on September 16th of every year, the anniversary of the heroic priest's attempt to throw off the Spanish yoke, the bell is rung by the President.

Mica. A piece of this mineral an inch thick can be split into nearly a thousand sheets, each as thin as the thinnest tissue paper. For its familiar use in the doors of stoves and as chimneys for incandescent gas-burners, it is split into sheets about as thick as heavy paper. These sheets are tough, elastic, and resistant to heat, and those made from the variety of mica called "muscovite" are almost as transparent as glass. The name muscovite, or muscovy glass as it used to be called, came from the fact that this mica was formerly in common use for windows in Russia.

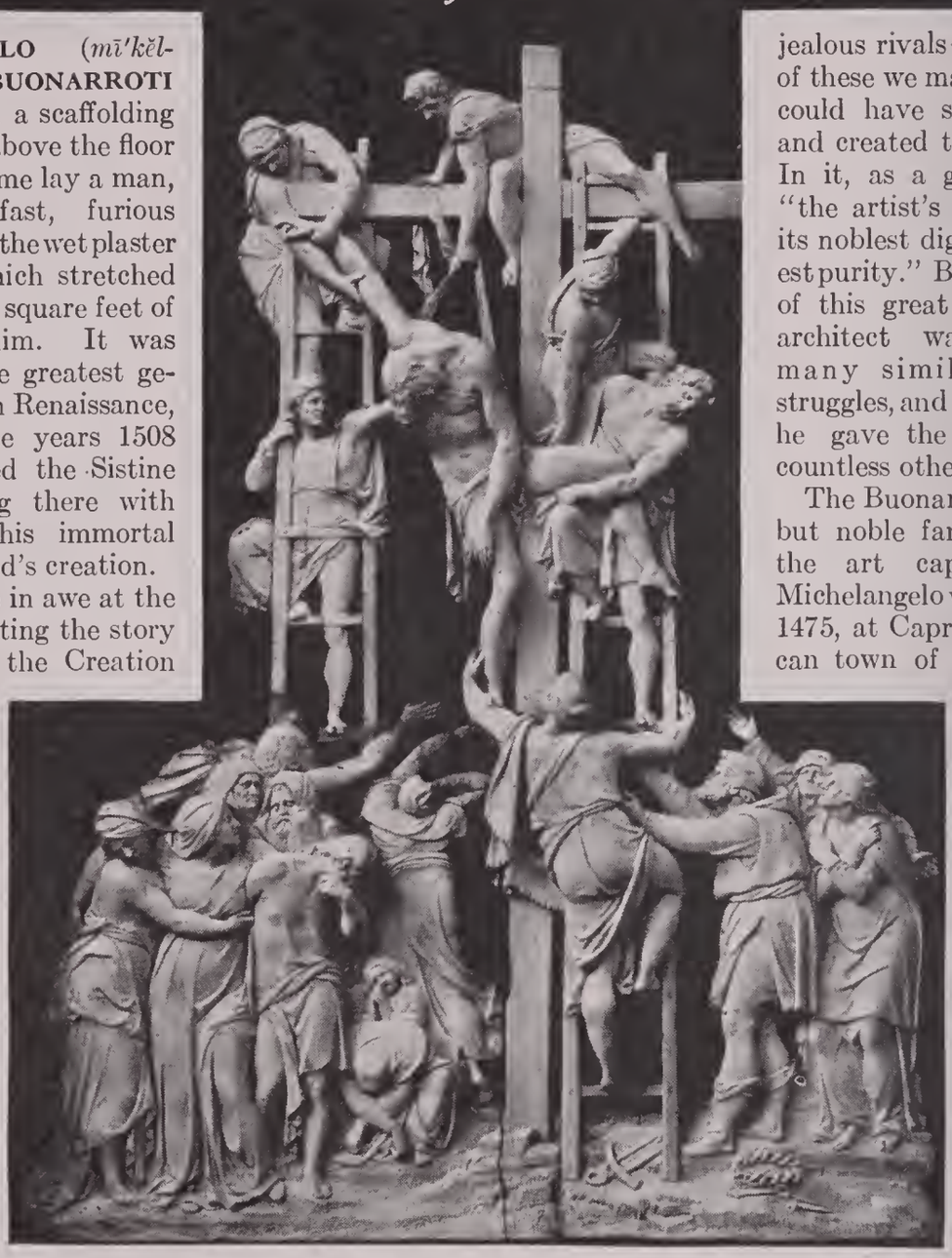
The chief use for mica today is as an insulator in electrical apparatus, since it is a poor conductor of electricity. Broken into small sparkling bits it is also much used as "spangles" to produce glittering effects on stage costumes and scenery. This use recalls the origin of the word mica, which comes from the Latin word *micare* meaning "to glitter."

All the varieties of mica are silicates of aluminum and other elements, that is, are compounds of silicon and aluminum with other things in minor quantities. Muscovite also contains potassium. About half of the world's supply of mica comes from India, and the rest from the United States and Canada in about equal proportions. In North Carolina, the richest field in the United States, the farmers mine it in primitive fashion and trade it to the storekeepers in exchange for goods. New Hampshire also has valuable mica lands in the White Mountains.

MASTER GENIUS *of the* RENAISSANCE

MICHELANGELO (*mī'kĕl-ăn'ĝĕ-lō*) BUONARROTI (1475–1564). On a scaffolding many dizzy feet above the floor of a chapel in Rome lay a man, painting with fast, furious master-strokes on the wet plaster of the ceiling which stretched its five thousand square feet of surface about him. It was Michelangelo, the greatest genius of the Italian Renaissance, who between the years 1508 and 1512 frescoed the Sistine Chapel, revealing there with titanic power his immortal vision of the world's creation.

Today we gaze in awe at the nine scenes depicting the story of Genesis from the Creation to the Flood. We see the hundreds of wonderful figures, some of which were actually painted within three or four days, showing the ancestry of Christ, the ancient prophets, and the pagan sibyls, dreaming of the good that was to come to the world. We see in other panels stirring moments of biblical history and we can understand why artists call this "the most extraordinary piece of technical work ever accomplished."



This imposing statue group, 'The Descent from the Cross', expresses the deep religious feeling which inspired the work of Michelangelo in his later years.

And not only are we thrilled by Michelangelo's lofty conception and by his masterly technique but we are stirred also by his indomitable will and almost superhuman energy and courage, to endure the "great hardships, illness, and overwhelming labor" that the artist admitted accompanied this work. Even when we think of just a few of these difficulties—of the many months spent painfully lying on his back, of the many peculiar technical problems, such as calculating difficult proportions from his scaffold for effects on the distant floor below, of his painting on over-wet plaster and thus seeing one-third of his work swallowed up by a winter mold, and of harassing worries caused by money troubles, a selfish family, and many jealous rivals—when we think of these we marvel how anyone could have surmounted them and created this perfect work. In it, as a great critic says, "the artist's spirit appears at its noblest dignity, in its highest purity." But though the life of this great painter-sculptor architect was filled with many similar hardships, struggles, and torturing worries, he gave the world this and countless other great creations.

The Buonarrotis were a poor but noble family of Florence, the art capital of Italy. Michelangelo was born March 6, 1475, at Capresa, a small Tuscan town of which his father was governor. He grew up, however, in Florence and soon began covering the walls of his home with charcoal drawings. At the age of 13 he was apprenticed to Ghirlandaio, the painter, who showed him how to copy drawings, mix colors, and lay the groundwork for frescoes. Then a year later he was admitted as one of the chosen pupils to the School of Sculpture which Lorenzo de' Medici, the great merchant prince and patron of art, had established in his palace gardens at Florence. Here, amid a famous collection of old Greek and Roman sculpture, the boy began to work, showing such skill in copying the head of a laughing faun that Lorenzo took him to live in the palace. Here he worked untiringly until he was 18. Then Lorenzo died, and two years later Michelangelo was in Rome, making great progress with sculpture, the art he loved best. The 'Pietà', the statue of the Virgin Mary holding the crucified body of her Son, was sculptured during his stay here, and its fame spread so rapidly that the sculptor was recalled to Florence.

There at the age of 26 he retired into a workshop built around an 18-foot marble block which another

For any subject not found in its alphabetical place see information

Here young Michelangelo is sketching upon a slab of marble with a burnt stick. He had to use such materials at first, because his father, thinking an artistic career beneath the family's dignity, did all he could to discourage it. Luckily for the world, this proved impossible.

contained in the Easy Reference Fact-Index at the end of this work

sculptor had half-spoiled 40 years before. When he removed this covering, two years later, the world gasped, for out of that cramped colossal mass he had created his youthful courageous 'David'—one of the world's greatest statues, of "spirit-quailing, awe-inspiring force."

The year 1505 found Michelangelo again in Rome, this time to design a tomb for Pope Julius II. It was to be a magnificent three-storied affair, covered with figures representing art and victory, and to make room for it the old church of St. Peter's was torn down and the erection of the new one begun. The delighted artist threw himself heart and soul into the work, even spending many months among the marble quarries to choose the material. But new orders from the pope, political upheavals, countless jealousies, and changes of plan after the pope's death interfered with the work. In the end Michelangelo completed three figures for the much reduced tomb, of which the 'Moses' is the most noteworthy.

THE MAJESTIC "MOSES"

This marvelous figure shows the prophet starting from his seat in blazing rage at the news that the Israelites have fallen into idolatry. Note the hands commencing to clench, the head upraised, and the body poised but not yet in motion. The statue, one of the greatest in the world, adorns the tomb of Pope Julius II in Rome.

During that period this mighty genius created many another significant work; for to painting, sculpture, architecture, poetry, engineering, and even to excavating among the ruins of ancient Rome, he brought a burning passion for work and a saint's devotion. Among his lesser achievements were his plans for the fortification of Florence, his opening of the road to the Carrara marble quarries, his recovery of the ancient Greek statue of the 'Laocoön', and his sonnets inspired by a high-souled Florentine lady.

But after all it is to his masterpieces on canvas and in stone, forever amazing us with their creator's marvelous skill of hand, his great knowledge of anatomy, and his grandeur of conception, that we turn again and again—masterpieces such as the majestic statue of 'Moses', said to be the artist's bitter protest against the worship of the golden calf which he saw in his own time; the statues of 'Dawn', 'Day', 'Twilight', and 'Night', for the Medici tombs; the monumental fresco of 'The Last Judgment', flaring with fiery daring 60 feet high at one end of the Sistine Chapel—the most famous single painting in the world; and last of all that greatest architectural achievement of the Italian Renaissance, the great dome of St. Peter's in Rome, a labor of love designed during his last years. Michelangelo's hand, as Emerson says, was indeed—

> The hand that rounded Peter's dome
> And groined the aisles of sacred Rome.

"Death plucks me by the cloak," he cried when he was 89 years old, and the brush fell from his hand. He was buried in the church of Sante Croce at Florence.

Honored as "more than mortal, angel divine," Michelangelo outlived his illustrious contemporaries Raphael, Leonardo da Vinci, and Correggio. Except for Titian, he was the last great figure of Italy's golden age of art. A stern and lonely dreamer, in the loftiness of his inspiration and in the number and variety of his immortal works Michelangelo still stands unrivaled. He is the best type of the universal genius which the Italian Renaissance produced beyond any other epoch in the world's history (*see* Renaissance). In him were summed up the vigor of mind and body, the restless energy, the boldness of spirit, the freedom of action and expression, the curious combination of worldliness and religious zeal which marked that great period.

The "WOLVERINE STATE" with Its Twin Peninsulas

Here is one of the famous peach orchards in the western part of lower Michigan. The sandy soil and moderate climate are ideal for the production of fine fruit crops, and every summer this district ships enormous quanities to market by rail and water. Thus the region which once was regarded as hopeless for agricultural purposes has been turned into a paradise of flourishing orchards.

Extent.—Northern peninsula, north to south, 164 miles; east to west, 318 miles; southern peninsula, north to south, 277 miles, east to west, 195 miles. Area, 57,980 square miles, excluding about 40,000 square miles of water surface of Great Lakes within the state boundaries. Coast line on Great Lakes, 1,624 miles. Population (1920 census), 3,668,412.

Physical Features.—Northern peninsula, rugged and hilly; Porcupine Mountains in west on Lake Superior (highest point, about 2,000 feet); low table-lands of limestone and sandstone in south and northwest. Southern peninsula, broad table-land in north bordered by gentle slopes, giving way to low level or slightly rolling country; highest point, more than 1,700 feet. Numerous small rivers and lakes.

Products.—Hay, corn, oats, wheat, rye, potatoes, sugar beets and other vegetables, fruit; copper, iron, salt, cement; automobiles, lumber and timber products, iron and steel products, flour and cereals, leather, drugs, and chemicals.

Principal Cities.—Detroit (about 1,000,000), Grand Rapids (140,000), Flint (92,000), Saginaw (62,000), Lansing (capital, 58,000).

MICHIGAN. If you were asked to name the state of the Union which has the longest coast line, you would naturally think first of Florida or California, because they border on the ocean. But the distinction actually belongs to the inland state of Michigan, which has a coast line of 1,624 miles on the Great Lakes. Florida's coast line is about 1,145 miles, and California's only about 1,100.

The "Wolverine State" owes its enormous coast line to the fact that it consists of two entirely distinct peninsulas which divide what would otherwise be one great inland sea into lakes Michigan, Superior, and Huron. And so the great seal of the state bears a Latin inscription which means, "If you seek a beautiful peninsula, look about you."

It was an accident of history that the two peninsulas, which are very different in character and entirely separated by water, should be united into one state. Michigan included originally only the lower peninsula. At the time of its admission to the Union as a state in 1837, it was hotly disputing with Ohio the location of the southern boundary; so when Congress decided in favor of Ohio, the upper peninsula was awarded to Michigan in compensation for the loss.

The immense mineral wealth of the new region was then unknown, and because of its rugged rocky character people thought it was of little value. In Congress Henry Clay opposed the project for the construction of the "Soo" canal at the point where St. Marys River separates the upper peninsula from Canada, saying that these straits were "beyond the remotest settlement in the United States, if not in the moon." Today the canals around the rapids of the "Soo" carry more than four times the traffic of the Suez canal, and that once despised peninsula is one of Michigan's greatest sources of wealth, for it is part of the rich Lake Superior iron and copper country, which is divided between Michigan, Wisconsin, and Minnesota. The copper deposits, which lie wholly in Michigan territory, are unique in that they are the only large deposits in the United States where the ore occurs chiefly as the native metal. For many years Michigan was the greatest copper-producing state, but it now usually ranks after Arizona, Montana, and Utah. In the production of iron Michigan is surpassed only by Minnesota. The timber resources of the upper peninsula are also important.

The gently rolling lower peninsula, which projects north between lakes Huron and Superior in the shape of a gigantic hand, can boast of resources no less great, though of a different kind. Here are rich farm and fruit lands, which form the state's chief source of wealth; here are the nation's greatest salt wells; here, too, are great deposits of limestone, clay, sand, gravel, and gypsum, convenient for use as building materials. There are deposits of low-grade coal, but most of the

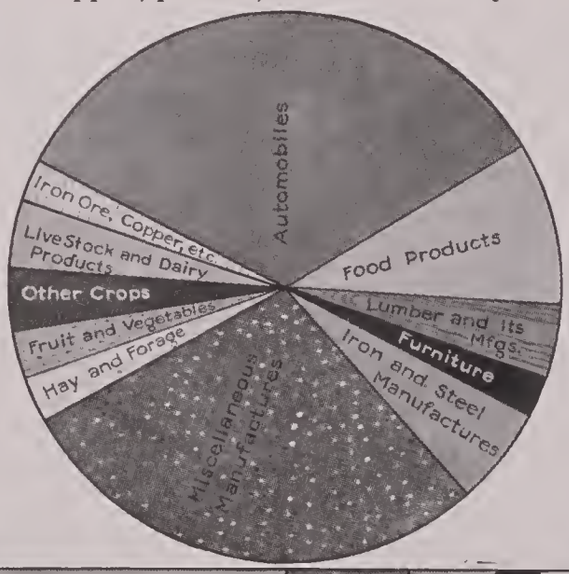
IN MICHIGAN'S FAMOUS CELERY DISTRICT

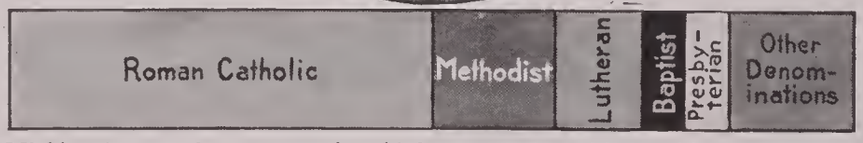
Celery is here being prepared for market on one of the farms near Kalamazoo. In its natural state celery is bitter, tough, and unsuitable for food. This condition was remedied in earlier days by banking the rows with earth. The stalks then turned white and acquired the flavor we all know. Now the celery growers save themselves much of this trouble, for they have found that closely packed plants will blanch themselves without earth, if properly confined between planks as is being done at the left of the picture. The process of blanching not only turns the stalks white, but makes them tender and crisp.

veins are too thin for profitable mining under present conditions. Along the Lake Michigan shore is a great fruit belt, some 30 miles wide, where apples, peaches, pears, plums, cherries, grapes, and small fruits are grown in abundance, thanks to the prevailing westerly winds from across the lake. By lengthening the cold season these winds tend to prevent early budding of the fruit trees and the consequent danger of destruction of the crop by late spring frosts, and by similarly prolonging the warm season they give the fruits plenty of time to ripen.

The farm lands produce large crops of corn, wheat, oats, hay, sugar beets, beans, peas, and potatoes. The Michigan celery beds are famous through the nation, and the state is the world's chief source of supply for peppermint, used in chewing-gum and for other flavoring. It is also one of the leading states in beet-sugar making and sheep raising.

A generation ago Michigan was the chief lumber state in the Union, but this industry has greatly declined, as the forests of both hard and soft woods were cut wastefully without regard for the future. Cities like Saginaw, which owed their rise to the lumber industry, have become general manufacturing centers. Large forest reserves, however, have been set aside, and it is expected that within a few years the timber industry can be partially revived.

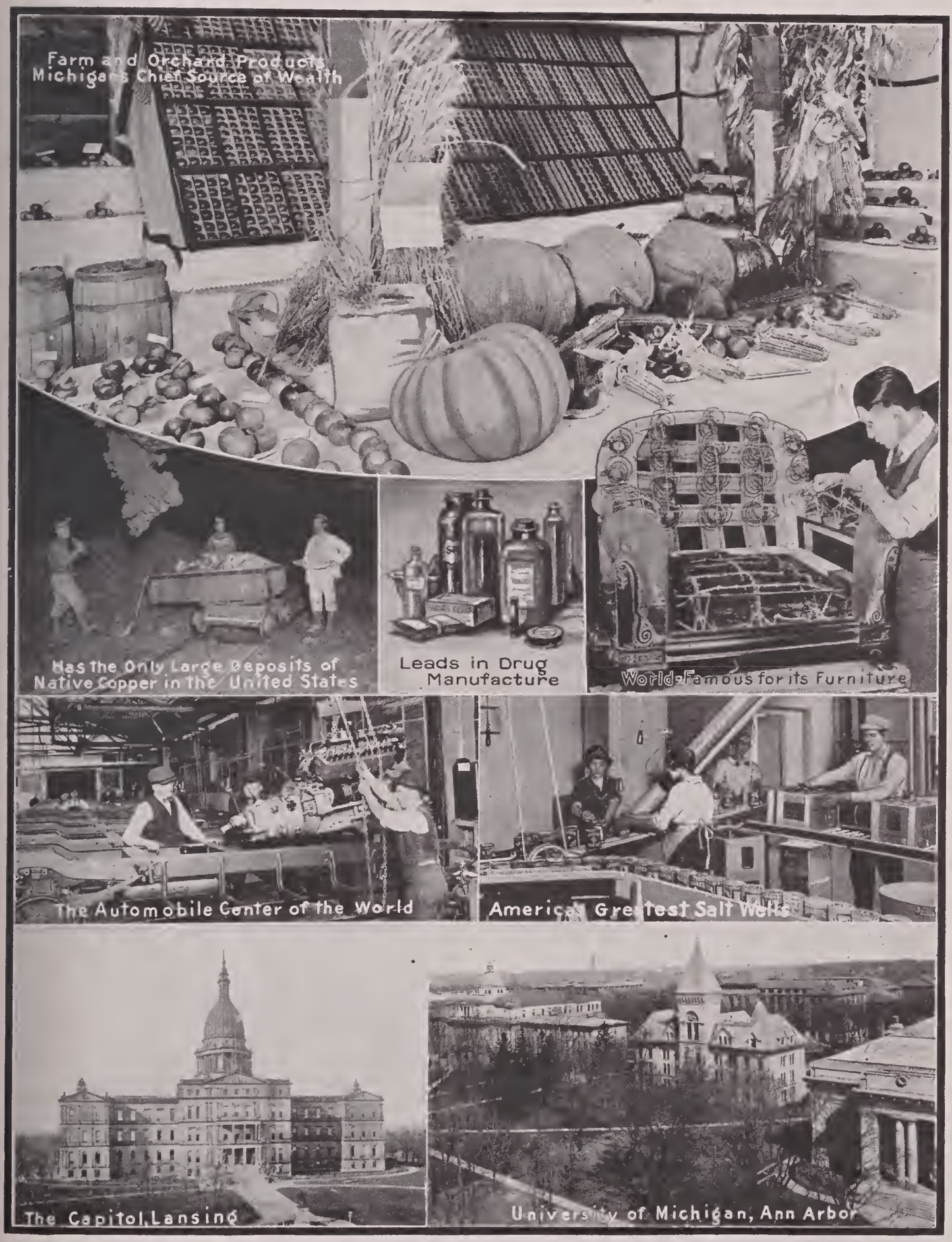




Michigan's manufactures are its chief source of wealth, as this chart clearly shows. Below you see the religious divisions of the people.

These vast resources of minerals and lumber, combined with the cheap transportation afforded by the Great Lakes, have made Michigan one of the great manufacturing states. The automobile industry leads all the rest. More than half the automobile output of the country comes from this state, and Detroit is the automobile capital of the world (*see* Detroit). Flint, Lansing (the state capital), Pontiac, and Jackson are all important seats of automobile manufacture. The manufacture of lumber and timber products comes second, including furniture, paper pulp, shingles, laths, tanbark, turpentine, and woodenware. Grand Rapids is one of the most celebrated furniture centers of the world, and its Furniture Fairs, held twice a year, attract visitors from all over the country and from abroad (*see* Grand Rapids). Most of the extensive manufacture of flour and grist-mill products is concentrated in the west-central part of the lower peninsula. The breakfast foods and other cereal preparations of Battle Creek are known all over the world, and they are closely

VIEWS OF MICHIGAN AND ITS VARIED WEALTH



What a variety of products combine to create Michigan's prosperity! Fruits and vegetables, copper, drugs, furniture, automobiles, salt—these are only a few of the things on the list. If there were room on the page, we should see the iron fields, the great forests of timber, the flour mills, the leather factories, the cement plants, and many others. Below we have a view of the State Capitol at Lansing, and of the University of Michigan, one of the most famous educational institutions in the United States. Michigan's position in the heart of the Great Lakes region gives the state valuable traffic facilities.

contained in the Easy Reference Fact-Index at the end of this work

associated with the sanitariums of that place. The manufacture of leather is also an important industry, owing its development largely to the great supplies of tanbark available. Michigan is the leading state in the Union in the manufacture of drugs, and stands at or near the top in other branches of the chemical industry. It owes this distinction largely to the fact that important chemicals are obtained as by-products of the salt and beet sugar manufactures. One of the world's largest chemical plants is at Bay City. A few of the other varied industries of the state are meat packing, cigar and tobacco making, and the manufacture of farm implements, carriages, wagons, railway and street cars, stoves and furnaces, paints and varnishes, portland cement, rubber, dyes, boots and shoes, and men's clothing.

In the commercial development of the state its splendid water system has played an important part. It has a multitude of short rivers, some of which have been harnessed to provide water-power; others afford easy transportation from inland points to the Great Lakes. The lower peninsula is dotted with about 5,000 ponds and small lakes, most of them surrounded by woodland and providing beautiful pleasure resorts convenient to nearly every part of the state. Some 300 islands lie off the shores of the two peninsulas and are included within the state boundaries. Many of them, especially those near the Straits of Mackinac, have become popular summer resorts because of their delightful summer climate, tempered by the cool waters of the Great Lakes. Les Chêneaux ("the Snows"), a group to the east of the straits, are famous for their muskellonge and other fishing. Isle Royale, an island 45 miles long just off the Canadian shore in the northwestern corner of Lake Superior, has important copper deposits.

Some of the most picturesque scenery of Michigan is the rugged mountainous upper peninsula. Along the northern shore are the so-called "pictured rocks." These sandstone formations are of various colors—gray, blue, green, and yellow—and they have been cut by wave action into many queer and fantastic shapes. Other sights of interest to tourists are the immense ore docks at Houghton and Hancock, from which most of the copper is shipped, and at the iron-shipping ports of Escanaba and Marquette.

The story of Michigan begins with the visits of French explorers from Canada. Jean Nicolet is especially remembered because he was the first white man to pass through the Straits of Mackinac, in 1834. When Detroit was founded in 1701 by Antoine de la Mothe Cadillac, the French took formal possession of the territory. After the defeat of Montcalm at Quebec, in 1759, the British became masters of this part of the New World.

The Indians under the leadership of Pontiac, the Ottawa chieftain, rose in 1763 in an attempt to drive the British out, and delivered an attack on all the British posts from the Straits of Mackinac to New York. They captured Fort Mackinac and massacred nearly all the garrison. Detroit was besieged, but without success.

At the outbreak of the Revolutionary War, the British lieutenant-governor at Detroit, Henry Hamilton, furnished the Indians with tomahawks and scalp-

HOW THE LAKES DIVIDE MICHIGAN IN TWO

As you see, Michigan is cut in two by Lake Michigan, the straits of Mackinac, and Lake Huron. The parts are known as "upper" and "lower" Michigan. The upper peninsula contains most of the state's mineral wealth, and also its best forests. Lower Michigan however contributes a wealth of fruit and other farm products, and has many thriving industries.

ing knives, and many of the settlers in the vicinity were massacred. By the Treaty of Paris (1783) at the close of the war, what is now Michigan was ceded to the United States; but disputes arose over the carrying out of the treaty and the British clung to the forts for ten years longer. Under the Jay Treaty of 1794, the British troops were withdrawn from Detroit in 1796.

Michigan was at first made a part of the Northwest Territory (1787), but in 1805 was organized as a separate territory. The opening battles in the War of 1812 were fought within its borders. Gen. William Hull, who was then governor, surrendered Detroit to the British and the settlements were left at the mercy of the Indians. The victory of Commodore Perry on Lake Erie, Sept. 10, 1813, restored Michigan to the American Union. In 1837 it was admitted as a state, and ten years later the capital was moved from Detroit to Lansing.

In the famous "Ordinance of 1787," under which Michigan was governed as part of the Northwest Territory, there appeared the following clause: "Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall be forever encouraged." This clause still has a place in the constitution of the state. It is not surprising, therefore, that Michigan was one of the first of the states to establish a public school system, which has been used as a model in many states. Most of the early settlers came from New England and New York, along the route of the Erie Canal. The state supports normal schools at Ypsilanti, Mount Pleasant, Marquette, and Kalamazoo. The state university at Ann Arbor is one of the largest in the country. Houghton is the seat of the Michigan College of Mines. The Agricultural College, established in 1857 at Lansing, was the first institution for agricultural education in the United States.

MICHIGAN, LAKE. The only one of the Great Lakes that lies entirely within the United States, Lake Michigan is also third of the group in size. It is 316 miles long, 75 miles wide on an average, has a coast line of 800 miles, and an area of 22,400 square miles. It is like Lake Huron, with which it connects through the Straits of Mackinac, in the fact that its surface lies 581 feet above sea level. The greatest depth is 868 feet. The natural flow of its waters is northward, but so low is the water passing near Chicago that a comparatively shallow 28-mile channel gives it an outlet to the Illinois River and thence to the Mississippi. This channel—the Chicago drainage canal—makes a link in a continuous water highway for small vessels from the Gulf of St. Lawrence to the Gulf of Mexico.

On Lake Michigan you will often meet huge car ferries, operated by railways, to ferry freight trains between Ludington in Michigan and Milwaukee, Manitowoc, and Kewaunee in Wisconsin. They are built large enough to carry 30 cars or more, and so strong that they can cross in any weather, even crashing through the ice sheet that sometimes stretches from shore to shore. Lake Michigan has two of the seven greatest lakeports of the United States—Chicago and Milwaukee. (*See* Great Lakes.)

MICROM'ETER. How thick is a human hair? If you were asked to find out you would be helpless unless you had one of the delicate gauges called micrometers (from the Greek words meaning "small" and "measure"). So precisely and delicately adjusted are these instruments that you could easily discover that the average hair is about $\frac{1}{500}$ of an inch thick. But this is a comparatively coarse measurement for modern science. In the manufacture of an automobile engine, for example, it is necessary to determine measurements as minute as $\frac{1}{10000}$ of an inch; for there are two operations which are not allowed to vary more than $\frac{3}{10000}$ of an inch from the standard. The fixed gauges by which such work is usually tested are constructed by the aid of movable micrometer gauges so fine that they can measure up to $\frac{1}{100000}$ of an inch. An ordinary cigarette paper would be 100 times too thick to go between the jaws of such a machine adjusted for its smallest measurement. For especially fine work a micrometer has been made which indicates differences of $\frac{1}{1000000}$ of an inch.

The principle on which most micrometers work is that of the screw. For a comparatively coarse machine, the screw has ten threads to the inch. It is turned by a hand wheel and one complete turn of the hand wheel advances the screw by the width of one thread, or $\frac{1}{10}$ of an inch. The wheel is divided about the rim into 100 divisions. A movement of the wheel through one of these divisions means $\frac{1}{100}$ of a revolution and advances the point of the screw $\frac{1}{100} \times \frac{1}{10}$ of an inch, that is, $\frac{1}{1000}$. Screws with more closely set threads give correspondingly finer results.

For the measurement of tangible objects the instrument is equipped with parallel-faced jaws, or pointed arms that spread outward to measure the inside of hollow objects, and these jaws or points are moved by the screw until they touch the object on each side. An electric current is sometimes used to determine the instant of contact. In telescopes and microscopes, however, where visual images are measured, the screw moves a ruled glass plate or a spider web across the object to obtain its measure. In the better instruments there are two hair-lines. First one side of the object and then the other is centered between the lines, and the turning necessary to produce the shift is the measure.

With such instruments minute organisms too small to be seen with the unaided eye can be precisely measured. The average diameter of the bacillus of tuberculosis, for example, has been found to be $\frac{31}{250000}$ of an inch.

The micrometer principle has also been applied to the construction of dividing engines, which will rule up to 120,000 lines to the inch. With such a machine, 14 parallel lines can be ruled on a space equivalent to the edge of the finest tissue paper.

EXPLORING *the Mysteries of the* INFINITELY SMALL

The Mechanical "Eye" that Shows Us Worlds of Wonder in a Drop of Water

The object to be viewed is carried on a glass slide which rests over a small hole on the stage (C). Light from the mirror (E) is cast up through the condenser (C) and passes up through the hole on the stage, brightly illuminating the object to be examined. The light from the object then enters the objective lens (B) where a reversed magnified image is produced. The eyepiece (A) enlarges this image further for the eye. (F) and (G) are focusing screws.

MICROSCOPE. A magician revealing fantastic worlds of wonder in a drop of water or a speck of animal tissue—such, indeed, is the microscope; but it is very much more than this also.

The telescope adds much to human knowledge, but in many ways the knowledge gained by the microscope affects our lives more directly. Up-to-date physicians use the microscope to track diseases to their sources in various forms of bacteria, and the conquest of many diseases is due primarily to the use of the microscope. Surgeons determine whether severe operations for new growths in the body are necessary by microscopic examination of a section of tissue. Botanists, biologists, and bacteriologists rely on it in their studies which enlarge the bounds of knowledge and increase man's mastery of nature. It is used to determine the physical structure of steel, iron, and other metals, and to detect adulteration in foods, drugs, starches, and paints; and the Federal Bureau of Animal Industry depends on it to detect parasites in meats.

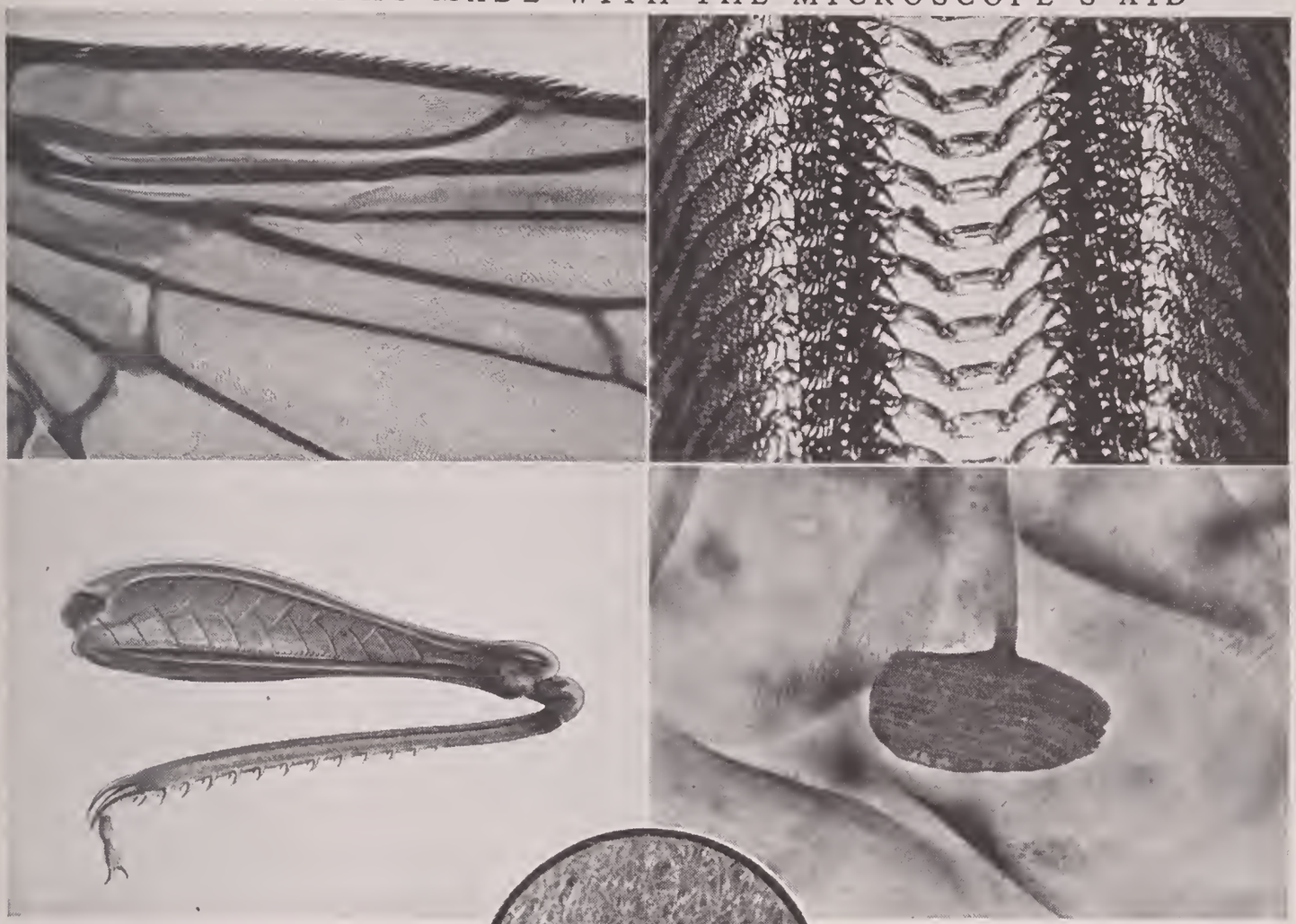
Ordinary magnifying glasses or simple microscopes—convex lenses used to obtain a magnified view of an object—were apparently known, at least as curiosities, from remote times; but the compound microscope was invented some time between 1590 and 1610. Galileo, the famous astronomer, is one to whom is ascribed the honor of inventing the microscope. Remarkable discoveries in anatomy and biology were made by the use of both forms in the 17th and 18th centuries. For example, the Dutch scientist Leeuwenhoek, sometimes known as the "father of microscopy," showed that weevils, fleas, and other minute creatures are not "spontaneously generated" but come from eggs; and the Italian, Malpighi, was the first to see the capillary circulation of the blood, previously inferred by Harvey. Yet, on the whole, the microscope remained a marvelous toy until comparatively recent times.

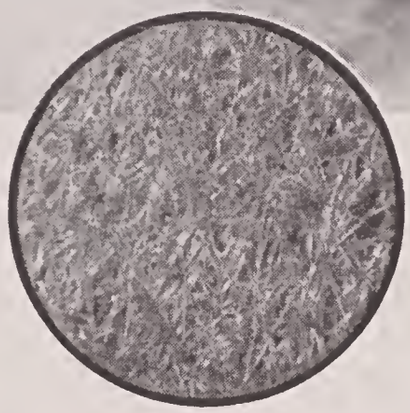
A simple microscope may be a single lens, or a set of lenses; if all are used together to view the object directly, it is a simple microscope. A compound microscope uses a lens called the object glass or objective to produce a reversed magnified image, and another, called the eyepiece or ocular, to magnify this image.

Both objective and ocular, in actual practice, are composed of several lenses, because lenses are subject to the two defects of spherical and chromatic aberration (*see* Lens). Spherical aberration can be cured by grinding the lens in a parabolic curve, that is, making the lens a little thicker in the center than if it were a slice of the outside of a sphere. The practical difficulties of grinding true parabolic curves are so great, however, that spherical aberration is ingeniously corrected by compounding the lens. Chromatic aberration is corrected by using a convex crown-glass lens and a concave flint-glass lens, and the curves of the two are contrived to supplement each other so as to cure spherical aberration at the same time. Often more than two lenses are used in the objective or the eyepiece.

The high-power compound microscope is a delicate, elaborate, and expensive instrument, requiring skill, training, and patience in its use. The tube carrying

PHOTOGRAPHS MADE WITH THE MICROSCOPE'S AID





In the upper left-hand corner is a House-Fly's wing, so much enlarged that you can plainly see the ribs and the curious texture of the wing surface. The right-hand picture shows a portion of the palate of the Abalone, a kind of shell fish. With the help of the microscope its linked structure is plainly evident. The lower left-hand corner shows the Grasshopper's hind leg, while the right-hand picture shows the "stridulating disk" with which the insect known as Water Boatman produces its curious noise. The circle shows a piece of paper, with the fine cellulose fibers appearing almost as coarse as hay.

the eyepiece is adjustable for different angles of observation and different distances from the objective. It is provided with a micrometer to measure the object, which is carried on an adjustable stage or, if very high powers are required, placed in oil or water between the objective and a cover glass, and illuminated by light thrown from a mirror through a condenser. A "camera lucida" attachment may be used to throw the magnified image on a sheet of paper on which it may be traced.

The Limits of the Microscope

The power of such a microscope depends on the power of the object glass, the power of the eyepiece, and the separation of eyepiece and objective—the greater the separation, the higher the power. Powers of enlargement of more than 2,000 diameters are attainable for visual use, and photographs of minute objects enlarged 5,000 diameters have been produced.

Is there any limit to this marvelous instrument? Can we not obtain ever higher and higher powers, so that at last we can peer into those ultimate mysteries —molecules, atoms, and electrons?

There are certain practical difficulties, the chief of which is not the imperfection of the instrument but the very nature of light and vision. We see non-luminous objects by the light which they reflect, and light is composed of waves. An object much smaller than the wave length of light cannot reflect light, any more than a pebble can break an ocean wave. Now, atoms and even the largest molecules are far below the size of light waves, and as for electrons, they are almost unimaginably smaller. The wave length of light also puts a limit to the magnification of telescopic images by the eyepiece (*see* Telescope).

Yet a way has been found to show, under certain definite conditions, not, indeed, the shape and size of ultramicroscopic particles, but their existence, number, and movements. An object too small to *reflect* light *diffracts* it—scatters it all around—and may be seen against a dark background as a bright point, or rather an almost infinitesimal disk, tiny indeed yet far larger than its real size. An "ultramicroscope," so called, is a microscope with attachments to show ultramicroscopic

particles viewed across a shallow beam of intense light against the darkest possible background, as dust particles are seen dancing in a sunbeam traversing a dark room. These movements are called the "Brownian movements." A powerful microscope of the ordinary type will show objects a few microns in diameter (a micron is about $\frac{1}{25000}$ of an inch); with the ultramicroscope objects measured in *thousandths* of microns may be perceived. Though this is still coarse work so far as solving the mystery of matter is concerned, the ultramicroscope is nevertheless a useful instrument.

A long-range microscope has been invented for viewing the actions of small insects, and recently moving pictures of such small creatures have been shown.

Here we see Puck, the mischievous sprite of 'Midsummer Night's Dream', sitting on a toadstool surrounded by his elfish crew.

MIDAS. According to mythology, Midas, an ancient king of Phrygia, in reward for a kind act was promised by the god Dionysus whatever he should ask. Believing gold to be the best possible thing, he asked that everything he touched might turn to gold. When the request was granted, he found to his sorrow that there are many things more necessary, for even his food became gold, and, in danger of starving, he begged the god to take back the gift, and make him once more like an ordinary mortal.

According to another story, Midas once decided a musical contest between Pan and Apollo, giving the prize to Pan. Apollo in revenge gave him a pair of ass's ears to show the god's opinion of his musical judgment. Midas hid his ass's ears under a cap, but his barber discovered the secret and was so oppressed by it that he dug a hole in the ground and whispered into it: "King Midas has ass's ears." A reed is said to have grown from this hole, and its whisperings spread the secret everywhere.

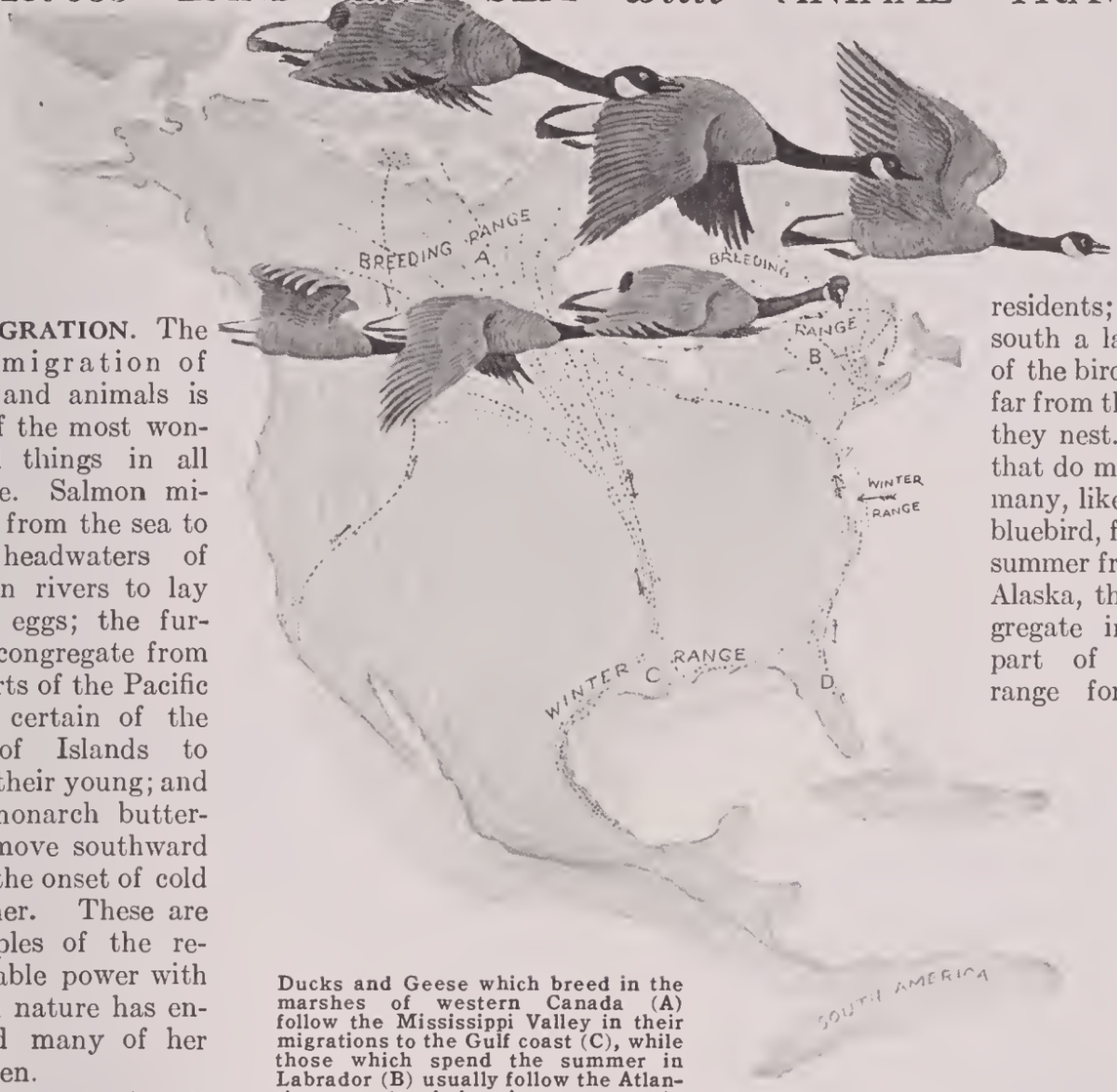
'MIDSUMMER NIGHT'S DREAM'. According to the plot of this fanciful comedy, written by Shakespeare, Oberon, king of the Fairies, and Puck or Robin Goodfellow, his elfin lieutenant, set out to bewitch Titania, Oberon's fairy queen. Discovering two pairs of lovers wandering in the Athenian wood, they include them also in their enchantments, as well as a company of workmen who have come into the wood to rehearse a rustic play with which to win the favor of the Duke of Athens on his wedding day.

Queen Titania awakes from sleep to be most absurdly in love, under the enchantment, with "bully Bottom, the weaver," the chief of the clownish actors, on whom the mischievous Puck has placed an ass's head. In a highly comic scene her attendant fairies scratch Bottom's donkey-head and minister to his creature comforts, while their fond mistress kisses the "fair large ears" of her "sweet love." The wandering lovers wake to find their loves reversed, and charming Hermia is about to scratch out fair Helen's eyes. Puck, being a mischievous sprite, watches this sport in glee, but Oberon soon takes pity on them all, releases Titania from her foolish fancy, gives Bottom back his own foolish head, and the lovers their proper loves. Then at daybreak, all the human folk hasten back to Athens, the lovers to be wed, and Bottom and his friends to present their play—the oft-told story of Pyramus and Thisbe, two lovers who, kept apart by their parents, yet conversed through an opening in the wall that separated their houses. One night they planned a secret meeting. Thisbe, startled by the roar of a lion, ran away, dropping her veil. When Pyramus arrived and found the veil torn by the lion's blood-stained jaws, he imagined Thisbe had been slain and stabbed himself. Thisbe, returning, found the body of her lover and ended her life with the same weapon. As presented by the rustics, the tragedy becomes a laughable burlesque. With this "tragical mirth" the play ends.

MIGNONETTE (*mĭn-yŏn-ĕt'*). The French have given this delicately fragrant flower the name of mignonette, which means "little darling." In Africa and Asia Minor the mignonette is a plentiful weed, and carried to Europe and America it is one of our garden favorites. From the low mass of smooth green leaves rise spikes of inconspicuous blossoms of shaggy white and green, touched with bronze and brightened only by the little red anthers within. Find a spot where the soil is rather light when you sow the seeds, and you will have a continuous supply of these fragrant flowers.

Scientific name, *Reseda odorata*. Flowers have 4 to 7 spreading sepals and the same number of petals attached beneath the ovary. Stamens, 10 to 40; anthers are large, dull, and a reddish orange; leaves alternate and spatulate, sometimes notched or 3-lobed; stem upright.

Across LAND *and* SEA *with* ANIMAL TRAVELERS



Ducks and Geese which breed in the marshes of western Canada (A) follow the Mississippi Valley in their migrations to the Gulf coast (C), while those which spend the summer in Labrador (B) usually follow the Atlantic coast to their winter resorts in Florida (D). The sea-ducks, known as Scoters, follow in their annual migrations that peculiar line marked by the arrows at the right, swinging over south of the Great Lakes to their breeding grounds, then back through Labrador and due south again. The arrow-line at the extreme left shows how Ross' Goose migrates between the Arctic Circle and California.

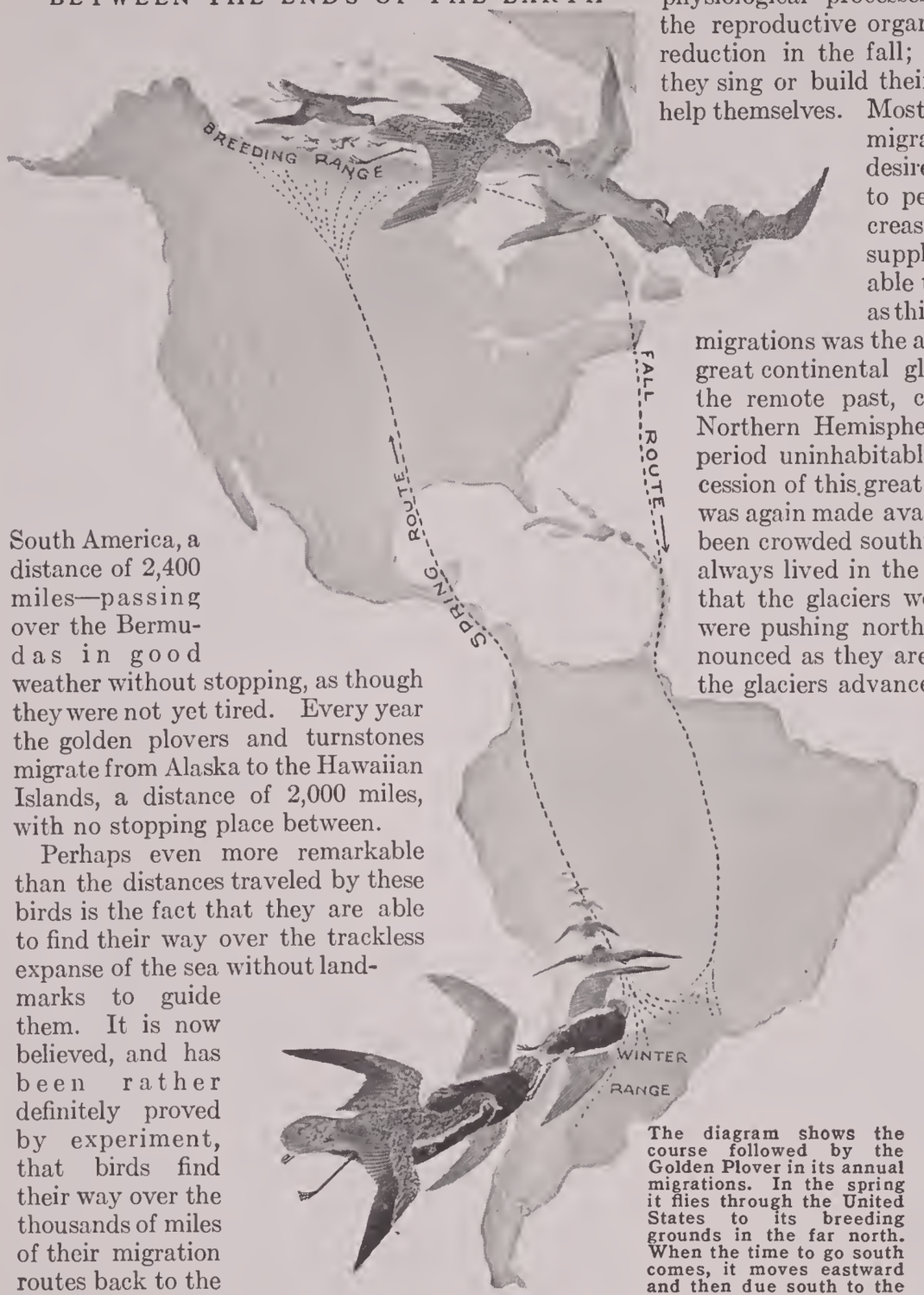
MIGRATION. The migration of birds and animals is one of the most wonderful things in all nature. Salmon migrate from the sea to the headwaters of certain rivers to lay their eggs; the fur-seals congregate from all parts of the Pacific upon certain of the Pribilof Islands to raise their young; and the monarch butterflies move southward with the onset of cold weather. These are examples of the remarkable power with which nature has endowed many of her children.

But where in all the book of nature will you find anything to compare with the journey of the little bobolink, that makes the fields of northern United States ring with melody during the summer? Long before cold weather sets in, he starts on a journey which takes him 5,000 miles over land and sea, over forest-covered mountains and grass-covered plains, to the pampas of southern Brazil; only to return once more the following spring, to exactly the same clover field and the identical patch of daisies from which he started! Even more wonderful is the journey of the Arctic terns, some of which nest within the Arctic Circle, and all of which winter on the islands of the Antarctic Ocean. Their summer and winter homes are separated by 10,000 miles of ocean, over which they migrate with the unerring flight of a homing pigeon that has been taken but a few miles from its loft.

It must not be thought from this that all birds migrate, or that all who do migrate travel long distances. Even in the northern United States and Canada, many of the woodpeckers, nuthatches, chickadees, grouse, and other birds are permanent residents; while farther south a large percentage of the birds do not travel far from the region where they nest. Of the birds that do migrate, there are many, like the robin and bluebird, found during the summer from the Gulf to Alaska, that merely congregate in the southern part of their breeding range for the winter. Others, such as the orioles, vireos, and hummingbirds, leave the United States, but go only as far as Mexico or Central America. All but one of our flycatchers, however, over half of our warblers, and several of our sparrows, thrushes, rails, herons, ducks, and shorebirds are not content until they are well within South America for the winter. Indeed, certain of the sandpipers and plovers wander even to Patagonia, though they nest within the Arctic Circle.

Most of these long migrations are performed by night, for there are comparatively few birds that can feed while they fly, especially in open country; and they must therefore reserve the daytime for feeding. On cloudy nights, when the birds are passing low to escape flying in the clouds, one often hears them as they call to each other; but even if you are familiar with their daytime calls you can recognize but few of the notes which you hear at night. The distance traveled in any one night or in any one continuous flight is ordinarily not great, perhaps not more than 200 or 300 miles; but certain birds are known to travel enormous distances, apparently without stopping. The golden plovers, for example, leave Labrador and Nova Scotia for a direct flight over the Atlantic to

BETWEEN THE ENDS OF THE EARTH



The diagram shows the course followed by the Golden Plover in its annual migrations. In the spring it flies through the United States to its breeding grounds in the far north. When the time to go south comes, it moves eastward and then due south to the Argentine where it finds its winter home. In this flight it covers a stretch of 2,400 miles over water before reaching the northern limits of South America. This migration is exceeded in extent only by that of the Arctic Tern, which flies from the Arctic to the Antarctic.

South America, a distance of 2,400 miles—passing over the Bermudas in good weather without stopping, as though they were not yet tired. Every year the golden plovers and turnstones migrate from Alaska to the Hawaiian Islands, a distance of 2,000 miles, with no stopping place between.

Perhaps even more remarkable than the distances traveled by these birds is the fact that they are able to find their way over the trackless expanse of the sea without landmarks to guide them. It is now believed, and has been rather definitely proved by experiment, that birds find their way over the thousands of miles of their migration routes back to the very spot where they nested the previous year by means of a sixth sense, a *sense of direction*, which is so poorly developed in man that he can scarcely appreciate its power in birds. An instinct for home, preferably the place of their own birth, is apparently the cause of their return year after year to the same region for nesting purposes.

Migration Began in the Glacial Age

Many theories have been advanced to explain *why* birds migrate. Today birds are undoubtedly controlled entirely by instinct in their desire to migrate—an instinct which is closely associated with certain physiological processes, like the enlargement of the reproductive organs in the spring and their reduction in the fall; and they migrate, just as they sing or build their nests, because they cannot help themselves. Most ornithologists believe that migration had its origin in the desire, common to all organisms, to perpetuate their kind, to increase up to the limit of the food supply, and to occupy all available territory. Just as important as this impulse in stimulating their migrations was the advance and recession of the great continental glaciers that, at one time in the remote past, covered a large part of the Northern Hemisphere, and made it during that period uninhabitable to all life. With the recession of this great sheet of ice, all this territory was again made available to the birds that had been crowded southward, and to those that had always lived in the tropics. During the period that the glaciers were receding and the birds were pushing north, the seasons were as pronounced as they are today, so that each winter the glaciers advanced a short distance and the birds were pushed back, only to crowd forward again the following spring. The birds that were able to adapt themselves to this seasonal advance and retreat had an advantage over the others, and were the ones that eventually inherited all the territory available. Their comings and goings had by that time developed into an instinct which still carries many of them over thousands of unnecessary miles.

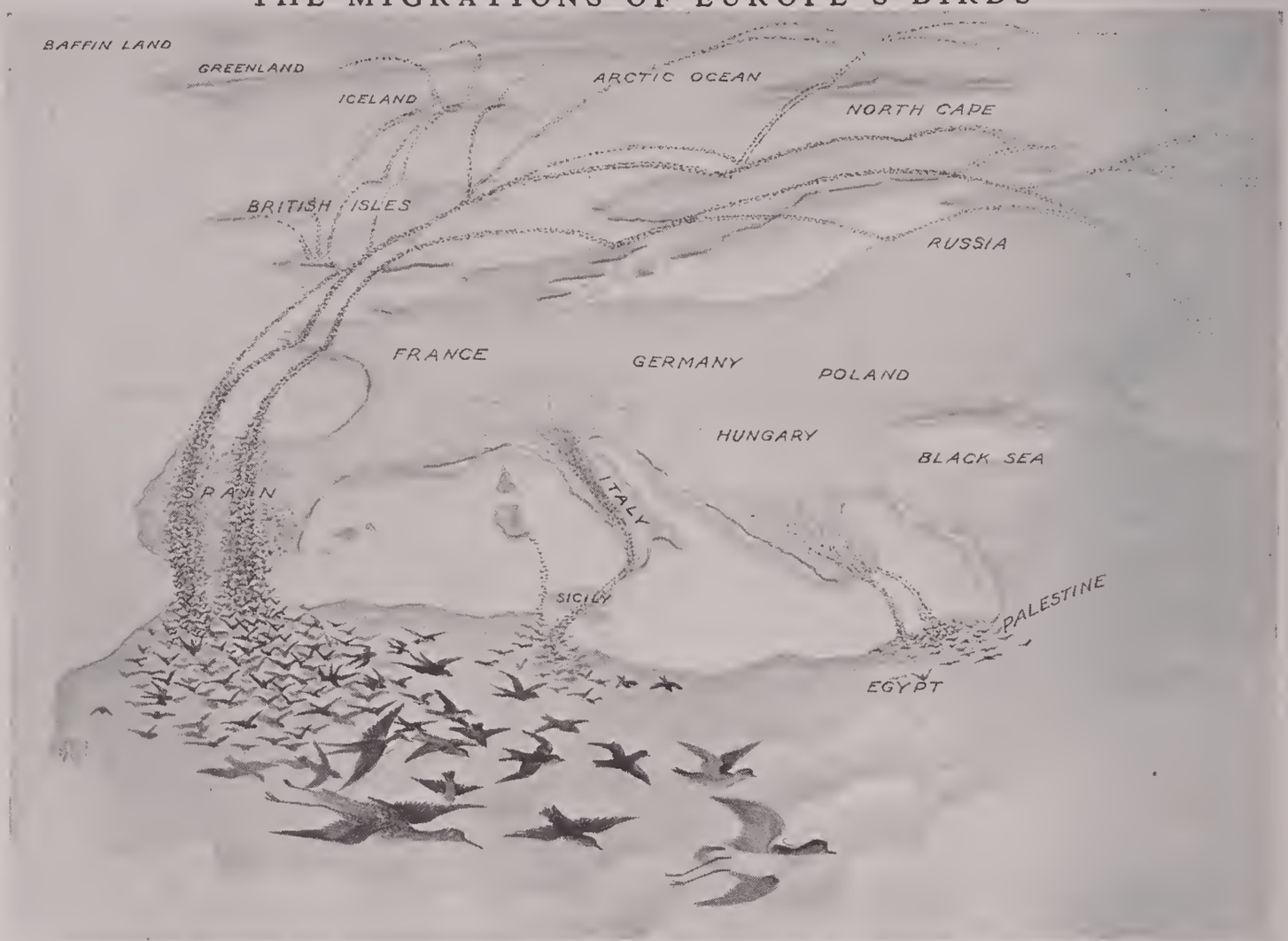
In the United States migration begins in late February, with a northward movement of the birds that have been wintering in the southern states; it continues until the last of May or the first of June, with the passage of many species that have been wintering in South America. The height of the spring migration occurs about the middle of May. Fall migration begins the last of June or the first of July, with the flocking of blackbirds and swallows and the arrival from the north of a few shore-birds. The height of the fall migration comes during September, but it continues into November and even December. January is usually the only month when no migration occurs. Unusual weather may alter these periods somewhat.

THE LEMMINGS STOP FOR NOTHING!

One of the curiosities of nature is the way in which the Lemmings move in great swarms over Scandinavia. When they decide to migrate they start across country, ravaging crops on the way, swimming streams and climbing walls. They continue in their headlong course until they reach the sea, and even there they do not stop, but plunge in and perish.

contained in the Easy Reference Fact-Index at the end of this work

THE MIGRATIONS OF EUROPE'S BIRDS



The picture shows the principal routes used by European birds in the seasonal migrations. One of the marvels of bird life is the unfailing exactness with which the established routes are followed year after year, generation after generation. These long flights are kept up at prodigious speeds, ranging from 25 to 100 miles an hour.

Higher animals also afford many interesting examples of seasonal migration. Deer, goats, sheep, antelope, and the like, in many parts of the world, regularly leave the plains for the mountains in early summer to escape the flies, and to find new grass and safer solitudes. Then as the snow and cold increase on the heights in the autumn, they seek the valleys and the plains again.

In addition to such seasonal migrations others of a more permanent character have occurred in the animal world. These may be compared to the "migrations of the nations" which sent the Angles and Saxons to Britain; and the Goths, Vandals, and other Germanic tribes wandering throughout the Roman Empire. We know, for example, the slow invasions and retreat of great glaciers in prehistoric times led to extensive migrations of animals in Europe and America, during which the mammoth and mastodon disappeared from the earth (*see* Ice Age).

Less marked migrations of a non-seasonal character still occur from time to time, though not on so great a scale. Squirrels and field mice sometimes become so numerous that famine besets them and they overflow in tremendous armies into neighboring parts of the country, where most of them perish. A most remarkable example is that of the Scandinavian lemmings, mouse-like animals of the mountains, which at intervals of from 5 to 20 years appear in enormous swarms in the cultivated regions of Norway and Sweden, working great havoc in farms and gardens. Undeterred by obstacles, these armies swim rivers and lakes, until they reach the sea, into which the little animals plunge to their death. No satisfactory explanation of their migrations has ever been found.

Many fishes and reptiles also perform long and complex wanderings, usually of the seasonal sort. In the spring there are great migrations of herring, salmon, shad, trout, mackerel, and other fishes from deep water to shallow, so that their spawn may be hatched in places suited to the needs of their young. Some turtles are said to migrate with considerable regularity. Some tropical crabs and even fishes have acquired the power of living out of the water for considerable periods, but they return to sea to deposit their eggs. Perhaps the most remarkable example of all is the eel, which is born in the Atlantic, migrates perhaps a thousand miles into the heart of Europe or America, where it spends its adult life, and then returns to the ocean depths to breed and to die. (*See* Birds; Eel; Fish.)

Milan (*mĭ-lăn'*), Italy. More than any other city in Italy, Milan today sums up the spirit of the Italian people, their strength and weakness, their sufferings and triumphs, their storied past and their modern development. Standing on the Olona River in the midst of the fertile plains of Lombardy, Milan from the earliest days was the natural axis around which turned the stirring history of northern Italy.

This position, which placed the city in the path of invaders armed with fire and sword, also made of Milan the gateway for commerce and prosperity, and while the need of strong and constant self-protection developed courage and independence in the Milanese, they also waxed rich and powerful.

Milan today is the center of the financial life of Italy and the second largest city in the kingdom, being surpassed only by Naples. Ever since it was taken from the Gauls by the Romans in 222 B.C. Milan has continued to grow despite the fact that it was sacked and burned once by the Huns, twice by the Goths, and once by Frederick Barbarossa as late as 1162.

These repeated ravages left virtually no relics of the Roman or early medieval days, but the city is rich in the buildings and treasures of later periods. Overshadowing all else is the world-famous cathedral on the Piazza del Duomo—the center of the city's life. It is the third largest in Europe, surpassed only by St. Peter's in Rome and the Cathedral of Seville. Forty thousand people can worship in it at the same time. The foundation was laid in 1386 by Gian Galeazzo Visconti, ruler of Milan. Many great architects worked upon it for centuries and it was at last completed by order of Napoleon in 1812. A canal was built solely to bring white marble for its construction from the quarries of Ticine, which had been permanently willed to the cathedral by the Visconti.

The cathedral is 486 feet long and towers 356 feet from the ground. The style is Gothic, very elaborately decorated, and there are more than 3,000 statues in its honeycomb of niches. Inside immense pillars support the naves, and huge stained glass windows, said to be the largest in the world, illuminate the tombs of many of Milan's greatest men. It was here that Napoleon was crowned King of Italy.

Second in importance among the many churches is that of Sant' Ambrogio, built by this saint in the 4th century, but twice destroyed and rebuilt. Here St. Ambrose baptized St. Augustine, and here also early emperors and kings were crowned with the "iron crown" of Lombardy, so called from its iron circlet made (so it was said) of a nail from the crucifixion. Not far away is the former convent of Santa Maria della Grazie, where Leonardo da Vinci's famous painting 'The Last Supper' appears on the refectory wall.

Milan has always been a seat of art and learning. Its artistic and literary life centers about the Brera Palace, the home of the Academy of Fine Arts and Science. Here is one of the finest picture galleries in Italy, containing paintings by Raphael and other famous masters. The city has two famous libraries, a large government school of agriculture and commerce, and the second largest opera house in Europe, the Teatro della Scala. Its academy of music is one of the oldest and finest in Europe. The archaeological museum of Milan is also celebrated.

Machinery manufacture is the largest factor in Milan's industrial life today. Locomotives and other railway equipment, automobiles, electrical supplies, carriages, and rubber articles are also important articles of manufacture. Here are centered the silk and cotton industries of Italy and the printing and furniture-making trades. Population, about 665,000.

After Milan had been rebuilt following its destruction by Barbarossa, the city suffered a century of civil strife. It then fell under the rule of the house of Visconti. The last Visconti duke died in 1447 and three years later began the rule of the Sforzas, continuing to 1535. Most of the ancient beauty of the city is due to these two famous houses. When the Sforza line died out, Spain seized Milan and held it until 1714. The city then fell to Austria and remained under Austrian rule until Napoleon created his shortlived Kingdom of Italy and made Milan its capital. After Napoleon's fall in 1815, Milan was restored to Austria. In 1859 it became part of the United Kingdom of Italy.

Mildews and Molds. We frequently find small downy or velvety patches called mildew or mold on the surface of leaves, fruit, damp cloth, moist foodstuffs, etc. Sometimes the growth covers a large area, with a film of soft cottony tissue, very thin. By using a powerful magnifying glass we can see that the growth is composed of a great number of tiny plants, so small that separately they cannot be seen by the naked eye. If we use a compound microscope we can see the structure of these tiny plants, and we discover that their thread-like bodies cover the surface on which they grow with a network of delicate cobweb-like strands or filaments.

DELICATE STRUCTURE OF BLUE MOLD

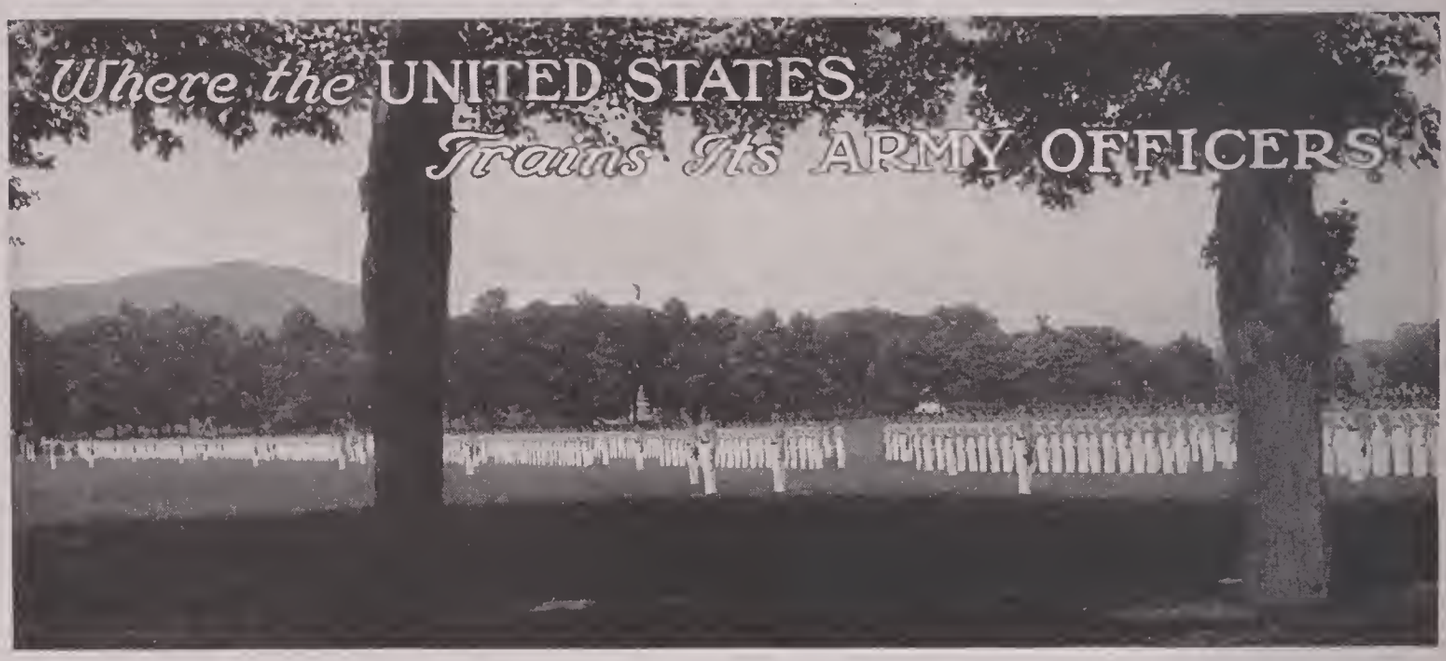
When bread becomes moldy you throw it away with disgust. But if you were to examine it under a microscope you would find the dark mass consists of tiny delicate plants like this.

Mildews and molds are one of the divisions of the *fungi*, which include toadstools, mushrooms, and many microscopic plants. Like all fungi, they are either parasites, living upon the bodies of other plants larger than themselves, or saprophytes, living upon dead vegetable and animal matter.

"Downy mildews" usually grow within the tissues or cells of plants, and thus do a great deal of harm to the stems and leaves, drying them up and making them curl and twist. One of the best known of these is the grape mildew, the larger part of whose thread-like body grows within the grape leaf, and sends out upon the surface masses of fibers which appear to the naked eye as small white patches. These patches generate tiny spores, invisible to the naked eye, which are carried by the wind to other leaves where they take root and grow into new mildew plants.

Powdery mildew can be removed from plants by dusting them with sulphur powder, or spraying them with some good "fungicide," or liquid used for killing fungi (*see* Spraying). The spores of green and black mold exist in the air almost everywhere. That is why damp bread and other food left standing in kitchens will almost always become covered with a furry green coat. To protect food from these molds, it should be kept in dry airy places.

Scientific name of true mildews, *Ascomycetes;* false or downy mildews and black molds belong to the *Phycomycetes.*



No matter how fine their own armies, foreign visitors never fail to express astonishment over the machine-like precision of West Point cadets on parade. After looking at this picture — those long files of cadets in dress uniform, each file as straight as a string, each man standing like a statue — you can easily understand why visitors are impressed. The same perfection is retained throughout the most complicated drills. The cadets move with a precision that merits the opinion often expressed of them — "West Point cadets are the best drilled body of men in the world."

Military Academy, United States. The band at the Military Academy at West Point, where young men are trained to be army officers, strikes up a stirring march. Down the grassy parade ground swing the long gray lines of erect cadets, with their rifles at "shoulder" glistening in the sun. Their dark high "tarbucket" hats, bearing jaunty pompons and emblazoned with the Academy crest, are held rigid by black chin-straps. Across their short gray tailed blouses, adorned with glittering gold "bell" buttons, they wear two white cross-belts extending diagonally over their shoulders to their waists. Their trousers are white, spotless, faultlessly creased.

With spirited perfect step they advance, every man gazing straight to the front, chest out, chin in. So evenly do the white-gloved hands swing, so straight are the ranks, so exact is every movement, that these hundreds of youths seem like one great machine.

Such amazing precision and efficiency are the result of the strict mental and physical discipline, whose Spartan rigor is impressed upon the new man from July 1 in his first summer at the Academy when he and his roommate are shown to their bare, rugless, pictureless little room in Cadet Barracks.

Soon after his arrival the new cadet dons a uniform of gray, black-banded cap, gray shirt, and gray flannel trousers. This is similar to the regular uniform he later will wear daily, consisting of short tight-fitting gray coat, the black collar-band of which buttons tightly around the neck, and gray trousers with black stripes down the sides. Promptly he begins under the supervision of officers the hard period of drills which are planned for the two months of summer.

On September 1 he begins in earnest his stern schooling. Almost every minute of a West Pointer's life is occupied according to rule. The lazy man has no chance here, for the entire régime is severe—more severe than in the military academy of any other country. During his first year—as a "Plebe"—he studies mathematics, English, French, and practical military engineering (surveying). During his second year—as a "Yearling"—he studies mathematics, English, French, political history, drawing, practical military engineering, and tactics. At the end of his second year he is given a furlough or vacation of two months. During his third year—as a Second Classman—his studies include natural

AN AIRPLANE VIEW OF WEST POINT

Here is the beautiful group of gray Gothic buildings on the Hudson, about 50 miles above New York, where the Army trains its officers. Prior to the World War, practically all the officers of the regular service were graduates of this academy, and West Point has impressed its spirit and traditions upon the entire service.

and experimental philosophy, chemistry and electricity, Spanish, and military hygiene. During his fourth year—as a First Classman—he studies military art and history, military engineering, law, ordnance and gunnery, and economics and government. During the summers following "Plebe" year and Second Class year, he is taken to some one of the great army encampments, such as Camp Dix (New Jersey), and trained by practical military exercises and maneuvers.

At the end of the four years, cadets who have met all the high requirements as to officer-like conduct, physical fitness, and scholarship are graduated as second lieutenants and are launched upon their career as regular army officers.

The Military Academy of the United States was founded by Act of Congress in 1802. Erected on a site now covering about 3,000 acres, it is one of the greatest military schools in the world, and certainly the most beautiful. The gray Gothic buildings with their castle-like towers and turrets stand on a lofty promontory 180 feet above the Hudson River, which here breaks through the Highlands in a winding gap.

6:00 A.M.—The reveille gun, bugle, and drums.
6:20—Police call. Cadets must sweep their own rooms, fold their bedding, and leave everything exactly in prescribed order.
6:30—March in ranks to breakfast.
7:15—Guard mounting. Certain cadets are detailed to patrol or guard the grounds.
8:00—Call to quarters. Cadets are confined to their quarters when not attending recitations. Alternate recitation and study periods now precede the march to dinner at 1 o'clock, and follow it until 4 o'clock.
4:00 P.M.—Mon., Tues., Thurs., and Fri.—Drills, alternating with supervised athletics. Varying according to classes and to seasons, these include infantry, cavalry, and artillery tactical drills; standing gun, siege battery, and sea coast battery drills; signal, and pickets and advance guard drills; target practice; field engineering; construction of temporary bridges; riding, fencing, boxing, wrestling, swimming, dancing, gymnasium, and the essentials of such athletic games as football, baseball, lacrosse, soccer, tennis, basketball, and hockey.
5:20—Recall from drill.
5:30—Parade. After parade the cadets march to supper, and half an hour after supper the evening period of study begins, lasting until 9:30.
9:30—Tattoo (prepare for bed).
10:00—Taps (lights out; inspection).

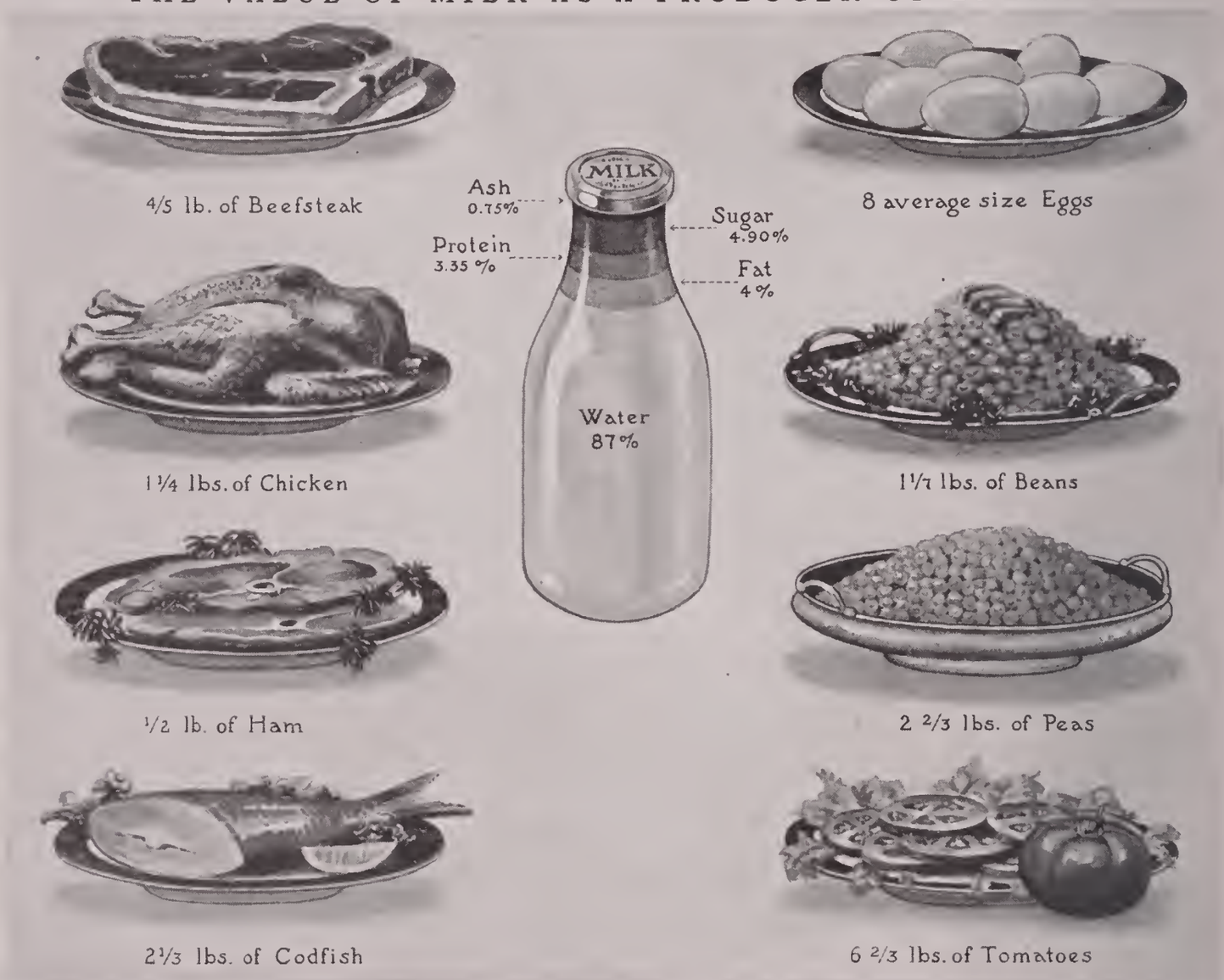
The Act of May 4, 1916, authorized an increase of cadetships to 1,332. Two are appointed from each congressional district, two from each territory, four from each state at large, and 80 from the United States at large. The President is also authorized to appoint not more than 180 cadets from among the enlisted men of the Army and the National Guard. All applicants must be single, 17 to 22 years old. They must agree to serve in the Army four years after graduation, and must either pass entrance examinations or present a certificate showing the equivalent of a thorough high school education. A cadet's pay, plus "commutation of rations," totals more than sufficient to cover all necessary expenses at the Academy. Indeed, the time of the cadets is so well filled that there is little need to spend money for "extras."

The village of West Point, the "Gibraltar of the Hudson" —about 52 miles north of New York City—was of considerable strategic importance in the early history of the country. During the Revolution it was fortified under the direction of the Polish patriot and engineer, Kosciusko, to whom the cadets have erected a monument by subscription. Benedict Arnold was bargaining to betray its fortifications to the British when the capture of Major André defeated the plot. Washington made his headquarters at West Point for a time, in 1779. The ruins of old Fort Putnam of Revolutionary fame are still to be seen.

MILK. Every human being lives for a time entirely upon milk. Indeed, milk is the chief food of all the higher animals or mammals during babyhood, for the food elements needed to build and nourish brain, muscle, and bone are found in milk in the most easily digested form. There is no substitute for milk in infant feeding, and milk and milk products are most important foods at all ages. Authorities tell us that in families where there are as many children as adults, as much money should be spent for milk as for meat.

Among English-speaking people, the cow furnishes by far the largest share of the milk supply, but the Laplander drinks the milk of reindeer, the Bedouins of the desert get their milk from the camel, and the roving Tatar drinks mare's milk. Sheep, goats, asses, buffaloes, and even zebus contribute, in one region or another, to the world's milk supply. Goat's and ewe's milk is rich in fats and is used in making some of the most famous European cheeses. The raising of milch goats is a prominent industry in Switzerland, and is being encouraged in England and the United States. Their freedom from disease makes goat's milk especially safe for feeding infants and invalids.

THE VALUE OF MILK AS A PRODUCER OF ENERGY



We need food for a variety of purposes — to build body tissue, to supply fuel for maintaining body heat and activity, and to maintain a reserve of fat. This diagram shows how valuable milk is as an energy producer — that is, for making "body fuel." The quart of milk in the center of the picture is equivalent in "energy value," measured in calories, to any of the other quantities of foodstuffs shown. Its efficiency as a body builder, which depends upon its protein content, is also high. In addition to this, milk has the advantage of being easily digested.

But whatever its source, all milk—animal as well as human—contains the same valuable food elements, though in different proportions. In good cow's milk there is about a quarter of a pound of food solids to every quart—as much as in three-quarters of a pound of beef. The most important of these solids are:

(1) butter fat, the chief constituent of butter; (2) casein or curd, which forms the body of cheese; (3) milk sugar, or lactose, which is less sweet than cane sugar; (4) ash or mineral salts, which builds bone. In the milk of the various mammals these foods occur in the proportion best adapted to the needs of its young. Therefore, the best food for the human baby is its mother's milk, and if other milk is substituted the composition is usually changed by the addition of milk sugar and water, the product being called modified milk.

The reason why no other food can take the place of milk and milk products is because the fat of milk contains an unknown something (called by some *vitamins*) not contained in other fats, which is absolutely necessary to the growth and vigorous health of children (*see* Vitamins). The casein of milk, moreover, is more easily digested than any other protein, and milk sugar is more readily assimilated than any other kind of sugar.

Of the many milk products butter is the most important because it is largely made up of the valuable fats. Cheese, which is made in a great variety of ways in the various countries, is rich in casein as well as fats. Ice cream is a valuable food, since it contains all the milk solids, unless it has been adulterated. Evaporated milk is whole milk with part of the water removed. It is made by heating the milk in a vacuum, so as to evaporate the water without overheating or scorching the milk. The thick syrupy product is run into tin cans and sealed while hot. Condensed milk is similar but with sugar added as a preservative. To make powdered milk, the heating is continued until nearly all the water is evaporated, and the thickened milk is then sprayed into hot air so that the dried milk falls in fine powder. Besides taking up less room than fresh milk in storage and shipment, evaporated, condensed, and powdered milk can be kept indefinitely and be shipped long distances. By simply adding water, a product is obtained closely resembling fresh milk. After the removal of fats and casein to make butter and cheese, the whey still contains milk sugar. This is removed for use in the preparation of infant foods and also in making "sugar-coated" pills.

Buttermilk, the fluid which remains after churning for butter, is a nutritious and popular drink. It gets its acid flavor from the conversion of much of its sugar into lactic acid. There are several fermented milk drinks, the best known of which is the kumiss, originally made by the Tatars from mare's milk. This is now made on a large scale from cow's milk in Europe and America for invalids. Malted milk is made by mixing whole milk with the liquid obtained from a mash of ground barley, malt, and wheat flour, and drying into a product like powdered milk.

Casein has a wide use in the industrial arts in addition to its use as a food. Millions of pounds are imported every year into the United States from South America. The bulk of the supply is used in the manufacture of coated papers to produce the smooth surface necessary for fine half-tone printing. It also enters into the manufacture of oilcloth, water paints, calcimine, and various enamels. Hardened by a special process, it makes an artificial plastic like celluloid used for buttons, electric insulation, combs, etc.

Millet. One-third of the world, it has been estimated, uses millet for its food. In the densely populated Asiatic countries and in many parts of Africa, the great variety of seed-bearing grasses to which the name is applied form the chief cereals, the seeds being ground up for meal, or parched, or even eaten raw. Yet Americans hardly know the taste of these cereals, for in this country they are usually grown only for hay, for silage, for poultry food and bird seed, or as a catch crop to be plowed under for enriching the soil. Millets are exceedingly prolific, and have been cultivated in the Old World since prehistoric times. The seeds of common millet are smaller than in the commoner cereals, but far more numerous.

The millets cultivated in the United States may be divided into three groups: Foxtail millet, which, because of its mass of strong fibrous roots, is often sown as a breaking-crop, and which endures heat well but requires a great deal of moisture; barnyard millet, including many coarse-growing grasses often found wild in waste places; broomcorn millet, the commonest of all, which is much grown in the Northwest because it matures readily in the short dry season of that region. Certain sorghums such as Kafir corn and durra are sometimes loosely classed as Indian or African millet (*see* Kafir Corn; Sorghum).

Scientific name of foxtail millet, *Setaria italica;* of barnyard millet, *Panicum crusgalli;* of broomcorn millet, *Panicum miliaceum.* The *Panicum* family also includes nearly 100 other forms of grasses, only a few of them valuable.

Millet (*mē-yā'*), Jean François (1814–1875). "Wake up, my little François; you don't know how long the birds have been singing the glory of God!" It is a lovely spring morning in Normandy. An old French peasant woman bends above a child, coaxing him from dreams with reports of the wide-awake world out of doors.

Amid scenes like this the great peasant-artist Millet spent his early life; and the love of nature and of all things pure and true that in later years he put on canvas was the priceless gift of his wise old grandmother. The parents of Millet were farmers—intelligent pious people, who in the midst of their toilsome life filled their home with love. While the father and mother worked in the fields, the grandmother cared for the children. Her teaching became one of the greatest influences in the life of this artist.

Engravings in the family Bible early awoke in the lad François a love of drawing, but at that time he had little chance to gratify this taste. As soon as he was old enough he had to work with his father and mother in the fields. But the noon rest-hour gave him a little time in which to draw pictures, and at night he read and studied. At 18, when his brothers were old enough to take his place in the fields, the family

savings were put together and he was sent to the nearby city of Cherbourg to study art.

It was the beginning of a new life for the country boy—a life which had all the somber tones of Millet's own paintings, as well as their simple quiet dignity. For with all the poverty and sickness that shadowed it, home love, high ambition, and resolute cheerfulness saved it from tragedy.

The time soon came when the masters of the day could teach Millet little more. He found himself out of sympathy with their conventional and artificial spirit; but nearly 20 years went by before he discovered his life-work, and began to paint the fields and the simple peasant-folk he knew and loved so well. Portraits, sold for a few francs, copies of the old masters, and even sign-painting provided him with a meager living in Paris and Cherbourg.

Then in 1848 he went to the little village of Barbizon on the borders of the forest of Fontainebleau, near Paris. Here he lived the life of the peasants, and put on canvas such stories of that life as are told in 'The Man with the Hoe', 'The Water Carrier', 'The Sower', 'The Gleaners', and 'The Angelus'.

Millet painted in the brown-gray earth tones of the fields; his great shadowy sower seems part of the very soil he plants. He did not idealize rural life as other artists had. He pictured it with the sternness, and yet with the glory which he had found in it.

"Some tell me," he said, "that I deny the charm of the country. I find more than charm. I find infinite glories. I see the halo of the dandelions, and of the sun also, but I see as well the steaming horses at work in the plain, and a man who tries to straighten himself a moment to breathe."

Artists and students understood Millet and his pictures, and many of the greatest of that day went to Barbizon to work with him. Thus arose the famous group of painters known as the Barbizon school. But public recognition did not come until the last ten years of his life. Just when life seemed brightening for him, his health failed, and he died.

Millet's pictures are now highly prized. The United States has a large share. The Chicago Art Institute has the 'Woman Feeding Chickens'; the Boston Art Museum has 'Harvesters Resting'; 'The Sower' and 'The Water Carrier' are in the Metropolitan Museum, New York; 'The Man with the Hoe' is in the San Francisco Museum.

"*That* MIGHTY ORB *of* SONG, *the* DIVINE MILTON"

The Puritan Poet Who Wrote 'Paradise Lost', One of the World's Greatest Epics—How He Sacrificed His Sight to the Service of His Country—His Unfaltering Courage in the Face of Tragedy

MILTON, JOHN (1608–1674). In the history of English Puritanism in the 17th century, two names stand out above all others—those of Oliver Cromwell, the man of action, and John Milton, the man of thought. Cromwell led Puritanism and the Parliamentary forces to their military triumphs over royalist tyranny and religious reaction. Milton wrote the great epic of Puritanism—'Paradise Lost'.

No man better typifies for us the spirit of his age than Milton. Born while the great men of the spacious Elizabethan days were still living, his boyhood saw the rise of Puritan influence in politics and religion. His middle years were spent in the thick of the contest for political and religious liberty. When Puritanism prevailed, Milton shared in its triumphs, holding a government office under Cromwell; and with its fall Milton's fortunes declined. And just as Puritanism won its greatest triumphs and accomplished its greatest work in molding the English character after the sword has been smitten from its grasp, so its poet did his greatest and most lasting work in the obscurity and retirement of his later years.

The life of Milton falls into three stages, clearly indicated to us by the youthful exuberance and grace of his earlier verse, the savage and bitter political writings of his middle years, and the sublimity and grandeur of the great epics of his blind old age. From boyhood he was destined by his parents for noble ends, and an atmosphere of culture, learning, and piety surrounded his earliest days. The elder Milton was a curious blending of the same opposing tempers that molded the poet's character—the enthusiastic and sometimes narrow piety of Puritanism, with the cultivated and artistic tastes, the broad interests, and the gayety of the age of Shakespeare. He was a scholar, educated at Oxford University, a keen London business man, a musician of talent, and yet a radical Puritan in politics and religion. He made his son's training a matter of foremost importance, encouraging his tastes, especially in music. The joy and ease and gayety of such Puritanism stand in striking contrast to the stern, rigid, joyless tone it often took.

After early schooling under a good private tutor and at the famous St. Paul's School in London, Milton was sent at the age of 16 to Christ's College, Cambridge, with the idea of fitting him to enter the church. Already he so delighted in study that he tells us that "from the 12th year of my age I scarcely ever went from my lessons to bed before midnight." The college life of that day, however, proved little to Milton's liking—not because he had to work too hard, but because, as he complains, he was "dragged from his studies" to some "frivolous" college task.

Young Milton's ambitions had by now centered on the ideal which he kept before him all the rest of his days—the accomplishment of some great poetic work. This was the gleam he followed, even in the midst of the stormy days of the Revolution and the Commonwealth, when patriotic duty called him to less con-

THE BLIND POET DICTATING 'PARADISE LOST'

There are few stories of human courage and triumph over obstacles which can equal that of Milton. Blind, thrust into a poverty-stricken old age, and with a lifetime of domestic unhappiness behind him, the Puritan poet managed to compose, by dictating to his daughters, the immortal epic 'Paradise Lost'.

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genial tasks. All his life, all his studies, were a preparation for 'Paradise Lost'. In college Milton formed no close friendships and kept much to himself, reading the masterpieces of the ancient and modern literatures and trying his poetic wings in short flights. His "soul was like a star, and dwelt apart," as the poet Wordsworth puts it. His aloofness and delicate beauty—for he had long flowing auburn hair and a freshly colored frank face, with poetic sensitiveness stamped on every feature—won for him the nickname of "the lady of Christ's College." It was at this time that he wrote the magnificent 'Hymn on the Nativity', one of the few great odes in the English language, though marred by a few youthful extravagances.

After seven years at college, during which his love of liberty—one of Milton's strongest passions—had decided him to renounce the design of entering the church, he went to live with his father at the little village of Horton. There he spent a long holiday of six untroubled years — the happiest years of his life. He continued his studies and meditations, with occasional trips to London for a concert or a theater. "I am pluming my wings for a flight," he writes to a friend. During this tranquil period he wrote several of his loveliest poems, 'Comus', 'Arcades', 'L'Allegro', and 'Il Penseroso'—delicate masterpieces penetrated by the free, full, rich, joyous spirit that was soon to vanish before the passions of the Civil War. Nothing in literature presents a more striking contrast than the poems Milton wrote at this period and the savage pamphlets he was soon to pour out in the service of the Puritan forces. We catch a hint of the coming change in the stern tone of the last great work of his tranquil life at Horton, the great elegy 'Lycidas'. Passages of this work mirror unmistakably the spirit of discontent that was soon to sweep away the old order from England.

Milton was not 30 years old and his talents were ripened to full maturity by years of enjoyment of the best that England could offer. His father's generosity enabled him to spend a year in travel on the Continent, studying the great monuments of antiquity and conversing with the great men of the time, among them the astronomer Galileo. In the midst of this enchanting episode, with his mind full of ambitious plans for the composition of an epic which England "would not willingly let die," came the news of the break between King Charles I and his Scottish subjects (1639). Milton knew well what this portended, and he hastened home to serve the cause of liberty.

The remainder of the poet's life was destined to be as unhappy as his first 30 years had been happy. For 20 years he now put aside his hopes and ambitions and plunged into the dusty arena, where tyranny in England was to receive a mortal wound. He poured out a stream of pamphlets, attacking the corruptions of state and church and upholding the ideals of the Puritan party. Radical, slashing, harsh attacks they were, and sometimes abusive and gross. One of his foes denounced him as "a grim, lowering, and bitter fool." But however Milton's controversial works may be marred by the faults of the age, he showed himself at every point a fearless champion of liberty—political liberty and religious liberty. Greatest of the works of this period is the immortal 'Areopagitica', a defense of the liberty of the press and universal toleration of opinion, whole passages of which have passed into the current coin of our speech.

TWO GREAT SPIRITS OF PURITANISM

Here Cromwell in armor is conferring with the poet Milton. Milton's task was to conduct the government's foreign correspondence and to write pamphlets in defense of the Puritan régime. When he was forced to choose between abandoning his work or becoming blind, he chose to work on and so lost his eyesight.

Milton's great opportunity came in 1649, with the triumph of Cromwell and the execution of Charles I. While many of the Puritan party were still trembling at the boldness of their leaders, Milton published a pamphlet upholding the right of the people to depose and execute a guilty sovereign. Such a man was too valuable a champion to overlook, and he was offered the post of Latin Secretary to the new Commonwealth. His duties were to conduct correspondence with foreign governments, and to compose pamphlets setting forth the views of the government. When Cromwell became Protector, Milton upheld his power, but in congratulating him on his victories he urged him on to further reforms, saying—

> Much remains
> To conquer still; peace hath her victories
> No less renowned than war.

For any subject not found in its alphabetical place see information

Milton's sight, already weakened, soon began to fail. In the midst of his magnificent 'Defense of the English People', physicians warned him that he must stop work or lose his sight. His characteristic reply was that, as he had already sacrificed his poetry, so he was now ready to sacrifice his eyes on the altar of English liberty. Complete blindness came in 1652, but he continued with an assistant's help.

In 1659 the Puritan revolt came to an end with the restoration of Charles II to his father's throne. Milton's period of public life ended also. With the collapse of the Puritan cause, in whose service he had spent the best years of his life and given his eyesight, he was now free, at the age of 51, to take up the poetic task he had put aside at 30. But how different now was his condition! Three-fourths of his fortune was soon swept away by the great fire of London (1666) and other losses, and for a time he was so poor that he had to sell his beloved books. As the author of the famous defense of the "regicides," he had to remain in hiding for some time, and his books were burned by the public hangman; no living man was more hated by the victorious Royalists. Threats of assassination made his life anxious, even after the danger of legal prosecution was past.

Blind, poverty-stricken, hated by the royalists, the poet's woes were crowned by domestic unhappiness. At the age of 35 he had married a 17-year old girl of a royalist or "cavalier" family. Unhappiness was inevitable. The gay frivolous girl found life intolerable with the sober Puritan, engrossed in his studies and in public affairs. She fled from him before the honeymoon was over; and Milton took his own unhappiness as the text for two radical pamphlets, challenging the current views of marriage and advocating the freedom of divorce. Two years later the repentant wife returned and the poet generously took her back without a word of reproach. She bore him three daughters before her death in 1653. Then, a few years later, Milton took a second wife. She died after less than 15 months of happiness.

The Dark Years of Old Age

So, in the years of his blindness and poverty, the poet found himself alone with three daughters, aged 17, 15, and 11, who gave him endless trouble. Under the weight of suffering and contention his temper had grown stern and exacting. Furthermore he shared to the full the Puritan belief in the inferiority of women. "One tongue is enough for a woman," he said contemptuously; and his unhappy motherless girls had received no more education than would fit them to serve as the blind man's eyes and to read to him endless volumes in languages of which they understood no word. Small wonder they rebelled. Finally in 1663, Milton married for the third time, this time happily, and his life ended in domestic peace.

The bitterness of those dark years is vividly presented to us in the lines he wrote at this time:

> On evil days though fallen, and evil tongues,
> In darkness, and with dangers compassed round,
> And solitude.

Milton's later portraits, showing a face deeply lined with sorrow, labor, and pain, tell more clearly than words the sad experiences which had been his lot. In passionate rebellion against his fate, he pours forth his woe through the mouth of Samson, the blind champion of Israel:

> How blind, disheartened, shamed, dishonored, quelled,
> To what can I be useful? Wherein serve
> My nation, and the work from Heaven imposed?
> But to sit idle on the household hearth,
> A burdenous drone; to visitants a gaze,
> A piteous object.

But with unshakable purpose and dauntless courage, Milton set about the task on which he long had meditated. Nothing in literature is more magnificent than the picture of the blind Puritan dictating day after day the superbly rolling periods of his great epic, which was to "justify the ways of God to man." In 1667, seven years after the Restoration, 'Paradise Lost' was published, the book which had an influence on the thought and language of the English race surpassed only by that of the Bible and the plays of Shakespeare.

The Immortal Epic Sold for a Pittance

Milton found a publisher for his great epic with difficulty; and his contract, which is still preserved, gives him only £5 ($25), with an additional £5 after the sale of each edition, up to a total of £20. Thus for his immortal work of more than 10,000 lines, he received in all less than $100. Venomous abuse was poured out on the poem by the Puritan-hating literary men. "The old blind poet," wrote one, "hath published a tedious poem on the Fall of Man. If length be not considered a merit, it hath no other." But John Dryden, the greatest poet of the Restoration, was wiser, for he said, "This man cuts us all out, and the ancients too."

But the remaining seven years of Milton's life were devoted to his second epic, 'Paradise Regained', and to his powerful tragedy, 'Samson Agonistes'. Contemporaries have left vivid descriptions of the life of those calmer days of tranquil simplicity. He would rise at four or five in the morning, listen while one of his daughters read a chapter from the Hebrew Bible before breakfast, then work until noon. After an hour spent in walking and another hour in playing on the organ or viol, he would continue his work till nightfall; when he would have a supper of "olives or some light thing," a pipe, and a glass of water. Visitors would often come in the evening. He died peacefully on Nov. 8, 1674, and was buried beside his father in the Church of St. Giles.

Milton's chief poetical works, with the dates of publication, were: 'Comus' (1637); 'Lycidas' (1638); 'L'Allegro' and 'Il Penseroso' (1645); 'Paradise Lost' (1667); 'Paradise Regained' and 'Samson Agonistes' (1671); 'Sonnets' (published at various times). His most important prose works were: 'Of Reformation Touching Church Discipline' (1641); 'The Doctrine and Discipline of Divorce' (1643); 'Of Education' (1644); 'Areopagitica, a Speech of Mr. John Milton for the Liberty of Unlicensed Printing' (1644); 'Tenure of Kings and Magistrates' (1649); 'Eikonoklastes' (1649); 'Pro Populo Anglicano' (1651).

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THE STORY OF PARADISE LOST

IN THIS great Puritan epic, Milton tells the story of—

> Man's first disobedience, and the fruit
> Of that forbidden tree whose mortal taste
> Brought death into the World, and all our woe,
> With loss of Eden . . . .

The poet plunges right into the heart of the great events which led up to the expulsion of Adam and Eve from Paradise. He takes us first to the abyss of Hell, into which the hosts of Heaven had hurled Satan and the other rebellious angels,

> Hurled headlong flaming from the ethereal sky,
> With hideous ruin and combustion, down
> To bottomless perdition, there to dwell
> In adamantine chains and penal fire,
> Who durst defy the Omnipotent to arms.

There they lie stretched out in their vast length along the burning lake, until Satan, concealing his despair, boasts that they will be successful in a second war on Heaven.

God in Heaven hears his speech, and lets the flames die down so that Satan may "heap on himself damnation" by a second trial. He rises on huge pinions above the lake, lights on the shore, and says defiantly to the dreadful realm of Hell:

> Receive thy new possessor—one who brings
> A mind not to be changed by place or time.
> The mind is its own place, and in itself
> Can make a Heaven of Hell, a Hell of Heaven.

The rebel chief then marshals his forces, and in an hour builds a huge palace of gold and bronze and marble, more beautiful than any palace of Babylon. A council of war is held at once, and Satan tells the assembly that he has heard rumors of a new world and a new race called Man whom God is about to create, and that perhaps these beings may be seduced to revolt. No one else is bold enough to undertake the perilous mission of finding this new world, so Satan takes it upon himself. He passes out by the gates of Hell, guarded by the foul monsters Sin and Death, after promising them the new race for their own.

Through the dreadful abyss of "Chaos and ancient Night" the Fiend wings his way, skirting the wall of Heaven and finally alighting on the Sun. There he takes the form of a "stripling cherub," in whose face "youth smiled celestial," so completely disguising himself that the good Archangel Uriel, whom he meets, shows him the way to the Earth, hanging on a golden chain from Heaven. Triumphantly Satan speeds thither, alighting on a mountain-top not far from the Garden of Eden, the Paradise of delight in which God had placed the newly created parents of the human race.

He finds his way to the Garden, and, disdaining the gate, leaps over the barrier. After admiring the gentle beauties of hill and vale, the rich verdure, the "odorous sweets," he finds the Tree of Life—the forbidden tree—and sits upon it like a bird of prey.

He looks out upon the wonders of the place, the living creatures "new to sight and strange," and—

Two of far nobler sight, erect and tall,
God-like erect, with native honor clad
In naked majesty . . . .
For contemplation he and valor formed,
For softness she and sweet attractive grace,
He for God only, she for God in him.

SATAN PLOTTING MAN'S DOWNFALL

This illustration for 'Paradise Lost' was made by Doré, the great French artist. It shows Satan and Beëlzebub immersed in a lake of fire, into which they have been cast after their fall from Heaven. "Upright he rears his mighty stature" the poem says of Satan, and the two fallen angels busy themselves plotting how they can offend God most grievously.

These beings are Adam and Eve, who lead serene and happy lives in Paradise, which yields them "nectarine fruits" to eat as they sit—

On the soft downy bank damasked with flowers.

About them frisking play harmlessly the animals—

Sporting the lion ramped, and in his paw
Dandled the kid; bears, tigers, ounces, pards,
Gambolled before them; the unwieldy elephant,
To make them mirth, used all his might, and wreathed
His lithe proboscis.

In the shape now of a lion, now a tiger, now some other animal, the vengeful Fiend stalks round the happy couple and overhears the secret by which their downfall is to be worked—that the one command God has placed on them is not to eat of the fruit of the Tree of Knowledge. When Satan hears this he exultantly says to himself:

O fair foundation laid whereon to build
Their ruin! . . . .
. . . . . Live while ye may,
Yet happy pair; enjoy, till I return,
Short pleasures; for long woes are to succeed!

Soon Adam and Eve retire to rest, for—

Now came still Evening on, and Twilight gray
Had in her sober livery all things clad;
Silence accompanied; for beast and bird,
They to their grassy couch, these to their nests
Were slunk, all but the wakeful nightingale.
She all night long her amorous descant sung.

When all has sunk to rest Gabriel, who guards the gates of Paradise, sends two angels to search the garden. They find Satan crouched, "squat like a toad," at Eve's ear trying to corrupt her mind by dreams. They drive him forth, but the Fiend's work had already been done. On awaking, Eve tells Adam of the dream in which Satan had told her that the forbidden fruit would make her a goddess. Adam comforts her distress, and they sing a hymn of praise.

The Almighty was not ignorant of the stir that Satan had raised in Paradise, nor of his baleful schemes; so he summons Raphael, "the sociable spirit," and bids him visit Adam and warn him of danger. The winged spirit finds Adam sitting at the door of his cool bower, while Eve within is preparing dinner. Hospitably they invite the heavenly guest to share their meal of the choicest fruits of Paradise. Seated on mossy tufts about a table of raised turf, they hold a long conversation. Raphael tells his hosts the story of Satan's rebellion and defeat, and relates the story of Creation. He tells how, after the rebel angels had been hurled into Hell, God had made a new World and a new race, to take the place of Satan and his hosts. Adam in turn tells of his first experiences, how he had awakened to find himself lying on a bed of flowery grass, amid the warbling of birds and the

murmur of streams. And he describes how God, to relieve his loneliness, had taken from his side a rib, which he had fashioned into a creature—

. . . . so lovely fair
That what seemed fair in all the world seemed now
Mean . . . .

After warning Adam against the wiles of the Evil One, Raphael departs. Meanwhile Satan has been circling the Earth, and has decided to take the shape of the Serpent to work his evil purposes.

In the morning, Eve asks Adam to let her work apart from him on that day. Adam is fearful of danger, but at last consents; and Satan, greatly to his joy, finds Eve alone, "veiled in a cloud of fragrance." He goes toward her, not writhing along the ground but half-erect, "his head crested aloft and carbuncle his eyes." He

Curled many a wanton wreath in sight of Eve,
To lure her eye.

How Eve is Led Astray

Eve hears the rustling of his folds among the leaves, and is astounded that he uses the speech of Man. He tells her that she should be admired by all the world; here in Eden there is only Adam to know how beautiful she is; and that he (the Serpent) had received his power of speech by eating the fruit of a certain tree.

Eve answers:

Serpent, thy overpraising leaves in doubt
The virtue of that Fruit, in thee first proved.
But say, where grows the tree? . . . .

Satan leads her to the tree, and she recognizes it as the forbidden tree that bears the one fruit they may not taste, lest they die. Satan says that threat is false; and he has eaten and has not died. If Adam and Eve eat, they shall be as gods. Eve listens to the tempter, and eats the forbidden fruit. It seems to her that she has never tasted such delight, and she decides that Adam shall share with her in it. Adam is horrified, but resolves to eat the fruit and, if needs be, die with her, since without her he cannot live. And then, though—

Sky loured, and, muttering thunder, some sad drops
Wept at completing of the mortal Sin
. . . . . .
They swim in mirth, and fancy that they feel
Divinity within them breeding wings
Wherewith to scorn the Earth.

But soon their high spirits droop and they quarrel. Sleep does not refresh them, and they are ashamed of their nakedness. They make for themselves girdles of leaves, and then soon—

. . . . The voice of God they heard
Now walking in the Garden.

God asks them why they hide, and they confess their guilt. Adam says:

She gave me of the Tree, and I did eat.

Eve "with shame nigh overwhelmed," replies:

The Serpent me beguiled, and I did eat.

God pronounces punishment first upon the Serpent, decreeing that he shall thenceforward creep on his belly, and shall be hated by woman evermore. Eve's doom is to be always subject to her husband's will, and to bear children in sorrow. Adam's is to till the ground in the sweat of his brow, until finally he returns unto the ground.

For dust thou art, and shalt to dust return.

Rejoicing in his successful villainy, Satan meanwhile returns to Pandemonium and boastfully relates his deeds before the assembly of the fallen angels. He waits for their applause; to his surprise and dismay his ears are filled instead with the sound of hissing from innumerable tongues. Amazed he looks about, and sees that God has changed the rebel hosts into a den of swarming serpents with forked tongues, and —crowning horror!—Satan himself falls on his belly, a monstrous serpent.

Overwhelmed with grief, Adam and Eve at first wish for death; but gradually courage and hope return, and they resolve to bear submissively their lot. Prostrate they fall in the spot where God had judged them—

. . . . And both confessed
Humbly their faults, and pardon begged, with tears
Watering the ground.

The Son of God presents their prayers to the Father and intercedes for them. God accepts their repentance, and consents to the ultimate redemption of the race, but decrees that they must leave Paradise. The Archangel Michael leads them forth from the Garden by the hand, while the fiery sword waves behind them and the Cherubim take their stations to guard the Paradise they had lost. Sorrowfully Adam and Eve depart—

Some natural tears they dropped, but wiped them soon;
The world was all before them, where to choose
Their place of rest, and Providence their guide.
They, hand in hand, with wandering steps and slow,
Through Eden took their solitary way.

MILWAUKEE, WIS. The largest city in Wisconsin, Milwaukee lies on the west shore of Lake Michigan at the mouth of three converging rivers—the Milwaukee, the Menominee, and the Kinnickinnic. A city of homes and gardens and tree-lined streets, it is also a manufacturing center of first importance. It is one of the busiest of American lake ports, with an excellent harbor protected by two miles of government breakwaters in the beautiful Milwaukee Bay.

Coal and grain are the chief articles of the shipping trade, while the manufacturing establishments include great leather plants, knitting mills, machine shops, meat packing houses, flour mills, shoe factories, and brickyards, the latter producing a special cream-colored brick which has won for Milwaukee the name of the "Cream City." It is also a distributing point for the large cheese and dairy industry of Wisconsin. The Milwaukee breweries, once famed throughout America for their beer, have mostly turned their plants into "soft drink" factories.

The city has more than 200 churches, representing 24 religious faiths. It is the seat of a Roman Catholic archbishop and of a Protestant Episcopal bishop. Besides a well-organized public school system, it has many private educational institutions, including

Marquette University, conducted by the Jesuits; Concordia College, a Lutheran organization; the Convent of Notre Dame; Milwaukee-Downer College; a state normal school; and an extension branch of the University of Wisconsin. In addition to an attractive boulevard system, there are about a thousand acres of public parks.

The site of Milwaukee was first visited in 1679 by members of La Salle's expedition, who noted that an Indian village was situated on the "Melleoki" River. The first permanent settlement was made in 1818, when Solomon Juneau settled on the east side of the stream. Twenty-seven years later the city was incorporated and Juneau was chosen first mayor. German immigrants had begun to arrive in 1838, and the number increased rapidly until the city became one of the chief German centers in America. In later years immigrants of other nationalities have settled in great numbers—chiefly Poles, Scandinavians, Bohemians, Italians, and Syrians. Milwaukee is one of the strongest Socialist centers in the United States and has had several Socialist administrations. Population, about 460,000.

MIND. Whatever men mean by the word "I," when they say, "I know or believe, I suffer or rejoice," this, says a great psychologist, is the mind of man—it is that which thinks, remembers, reasons, feels, or wills. The dictionaries tell us that mind is "conscious intelligence" or the "faculty of knowing." The brain is the main seat of the mind, yet mind can scarcely be said to be absent from any tissue in which feeling resides, and some, with Herbert Spencer, would even assume the existence of a "mind dust" diffused with matter throughout the universe. Certainly an interrelationship exists between the physical body and the mind, and this is so nicely balanced that for either to be well and normal, the other must be well also. Thus the old Greeks were not wrong when they set up as their ideal "a sound mind in a sound body."

Psychology is the science which chiefly deals with mind, and it tells of an "unconscious mind" as well as the conscious one. Scientists differ in their views as to how far down in the animal scale a reasoning mind may be traced. (*See* Animal Kingdom; Brain; Psychology.)

MINERALS. "Animal, vegetable, or mineral?" we used to ask in the old guessing game, confident that what did not fit into the first or second compartment must belong in the third. We shall see, however, that not everything in the inorganic realm can claim the distinction of being a mineral.

Here, for instance, is a piece of volcanic glass; it is entirely inorganic, yet not a mineral, because not a substance of definite chemical composition. Here is baking soda or sodium bicarbonate, a perfectly definite chemical substance, yet not a mineral, because it is artificially produced. The free oxygen, nitrogen, and other gases of the atmosphere are other inorganic substances not regarded as minerals. What then is the proper definition of a mineral?

A mineral species has just as definite and distinctive an individuality as a species of tree or fish or bird. A mineral is an inorganic substance occurring in the earth's solid crust, directly produced by the processes of inorganic Nature, and possessing a definite chemical composition—though there are minerals, as tourmaline, for which no satisfactory formula has been worked out, but which are assumed to have a definite chemical composition in view of their characteristic crystalline structure. Some minerals are uncombined elements, but more are compounds. Almost all minerals (mercury and water are exceptions) are solid at ordinary temperatures. The form of crystallization (*see* Crystals) is another important identifying feature. Some minerals, however, occur in both crystalline and amorphous form, while a few are known only as amorphous substances.

Mineralogy, the science which deals with minerals, studies their chemical composition, their crystalline forms, their physical characteristics (such as luster, hardness, specific gravity, and color), their formation, occurrence, and uses.

The rocks and earths may be simple minerals, as quartz and kaolin; or each may be composed of several minerals, as granite and the complex clays.

The Raw Materials of Industry

Minerals are the raw materials from which are obtained all the metals; all acids, salts, and other chemicals except the organic chemicals; glass, porcelain, pottery, terra cotta, and bricks; refractory materials from which fireproof curtains, furnace linings, etc., are made; many pigments, such as ochre and umber, and graphic materials, such as graphite and lithographic stone; fertilizers, including potash and nitrates; mineral fuels (coal, petroleum, and natural gas); and gems. A single mineral may be the ancestor of a long line of useful derivatives. Thus common salt (sodium chloride) is the source of most of the other sodium salts.

Some countries are almost without native supplies of useful minerals; some, like the United States, have vast stores; but not one produces all the minerals it needs in quantities sufficient to meet all its needs. No country in the world comes so near self-sufficiency in mineral production as the United States. It is the leading producer of nearly one-half of the 30 most important mineral products, including the most important of all, coal, iron ore, copper, lead, and zinc, and contributes an important share of the world's output of all but seven of these leading mineral commodities.

Progress in material civilization has consisted largely in learning how to turn the mineral resources of the earth to use. We are only now learning what to do with some of the rarer earths and neglected minerals—as bauxite, the source of aluminum; columbite or tantalite, from which the rare and valuable metal tantalum is obtained; and monazite sand, from which are extracted the thorium and cerium used in making incandescent gas mantles.

Minerals are classified according to their chemical nature and physical properties. One of the most useful classifications is according to hardness on a scale of ten minerals, arranged in order from the hardest to the softest. The hardest, the diamond, is given an arbitrary "hardness value" of 10, and the softest, talc, has the value 1. The complete scale is: talc, 1; gypsum, 2; calcite, 3; fluor-spar, 4; apatite, 5; orthoclase, 6; quartz, 7; topaz, 8; corundum, 9; diamond, 10.

Minerals are tested for hardness by scratching, because the harder mineral will scratch the softer. If a given mineral, for instance, scratches orthoclase, but is itself scratched by quartz, its "hardness value" is between 6 and 7.

MINERVA. The Roman goddess of wisdom, science, and the arts, identified with the Greek Athena. Her oldest sanctuary at Rome was the temple built by Tarquin on the Capitol, where she was worshiped with Jupiter and Juno. Another of her temples, on the Aventine, was the meeting place for dramatic poets and actors, who were organized into gilds under her patronage in the 3d century B. C. All the schoolchildren had a holiday on the day of her festival, the 19th of March. (*See* Athena.)

How MAN WINS TREASURE *from the* EARTH'S DEPTHS

WHEN you look at a piece of coal or iron, or at gold and silver watches, rings, pins, diamonds, rubies, etc., in jewelry shop windows, you may recall that once, in their original crude states as minerals, metals, or gems, they were all snugly secreted by Nature in treasure chests in the earth, in some cases thousands of feet underground. But do you ever consider how the precious stores are got out of their hiding places and won for the use of mankind in making life effective, comfortable, secure, and beautiful? It is by the toilsome and fascinating processes described in this article.

MINES AND MINING. Mining is one of the great basic industries. The annual output of the mines and quarries of the United States, which produce about a third of the mining products of the world, usually ranges from $3,000,000,000 to $5,000,000,000 in value and makes up almost two-thirds of the country's freight traffic. To move an average year's output would require 500,000 freight trains of 40 cars each. Coupled together, these would be 151,000 miles long, and would wind six times around the earth. Three-fourths of all explosives used in the United States are used in the mining industry. The mines of the United States employ more than 1,000,000 men—about three-fourths of them being coal miners; the mines of the world employ 6,000,000 men. Millions more are employed in the allied industries, such as the manufacture of iron and steel, copper ware, coke, chemicals, etc., which are directly based on the mining industry.

The story of mining is one of tragedy and romance. The mining field is the world's roulette table. In a day the man who thought himself wealthy may become a pauper, the pauper may become a millionaire. A single stroke of pickax or spade has again and again uncovered a fortune. Yet for every fortune made in mining a hundred still remain. In modern times mining has lost much of its former element of chance, and now is organized and conducted much like other sorts of business, with perhaps a larger element of risk in the early stages.

Even the dangers of mining whet the imagination. Fire, water, poisonous gases, breaking ropes and ladders—no wonder the mountain miners of Germany peopled their mines with goblins and prayed to the saints before descending. The world little realizes the magnitude of the debt it owes to the "toilers of the deepest deep."

Let us follow the booted prospector in his quest for the modern Golden Fleece. With tent, pick, and spade, he sets out to "strike it rich." Often he faces the greatest hardships—hunger, thirst, wild beasts, and storms—and often he must spend months and years alone treking over burning deserts or desolate mountains. In early times he had to brave attacks by Indians and bandits.

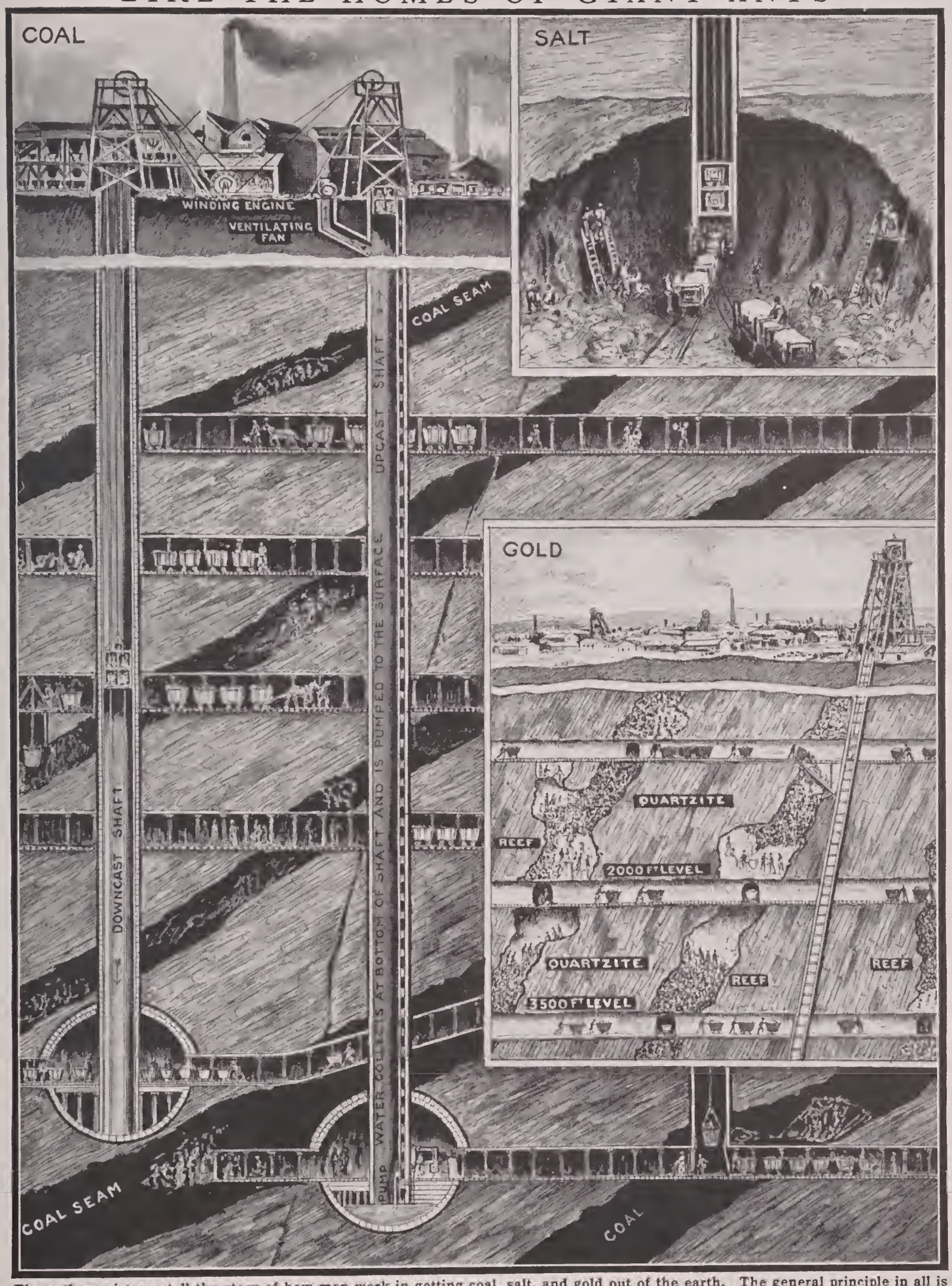
"Prospecting," that is, exploring and testing territory to determine first the presence and then the extent and value of the deposits, is a complicated art. The successful prospector of today must have some knowledge of mineralogy, metallurgy, and especially geology, which helps in determining the region in which useful minerals may be found, and often the actual location for opening a mine. Rusty-looking rocks may indicate iron. Deposits of magnetic iron are often discovered by their influence on the magnetic needle. The shape as well as the composition of stones or pebbles in streams is studied. An ore-bearing pebble well worn and rounded has traveled a considerable distance; but if it is still angular the prospector seeks his mine closer at hand.

Suppose the prospector has finally determined that the desired mineral is present in a given region. To determine the extent of the deposit he may make further examination by stripping the soil off a considerable area; or he may dig shallow pits, or trenches. Mining fields throughout the world are dotted with such excavations, each telling, in its abandonment, a story of some toiler's hope and failure.

The more usual method of testing ground is by borings, made by means of a diamond drill, a long metal tube with black diamonds at the ends for cutters. When rotated at high speed, the tube extracts a core of rock. Holes have been thus drilled several thousand feet deep, in some cases at the rate of 60 feet a day. In hard rock, however, the rate is very much slower.

If these explorations indicate valuable ore, the prospector or the company stakes out a claim, and begins to develop a mine. Mining methods vary according to whether the minerals are found (1) in alluvial deposits (gravel, sand, silt, etc.) on the sur-

LIKE THE HOMES OF GIANT ANTS



These three pictures tell the story of how men work in getting coal, salt, and gold out of the earth. The general principle in all is much the same, the excavated material being brought to a shaft and hoisted to the surface. You can see also how the veins or seams of the minerals are followed by the miners in their underground burrowing.

contained in the Easy Reference Fact-Index at the end of this work

face; (2) in layers or beds beneath the surface, like iron ore, coal, and salt; or (3) in veins or seams (often called "lodes"), some of which are merely fillings in old cracks or fissures in rocks.

Mining in alluvial deposits is called placer mining. Placer mining is carried on in various ways, but the essential thing is to cause water to flow over the sand and gravel, so as to wash away the lighter material and leave the heavy and useful mineral behind (*see* Gold). "Open-pit" mining is the term applied where ores are uncovered and scooped out with the aid of steam shovels. The latter method is widely used in the Minnesota iron mines, and in some of the copper mines of the southwest.

Making Shafts and Tunnels

For vein and bed deposits beneath the surface, tunnels or vertical or inclined shafts are dug from the surface to the substance to be mined. Tunnels are made especially where the ore body lies in the side of a mountain. Tunnels form the best method of mining, for conveying ore horizontally out of a tunnel is much cheaper than hoisting it up through a shaft, and by having the tunnel on a slight incline drainage or pumping expenses are curtailed. In the middle western United States, it is common to see the mouths of mines leading into the sides of hills, like dirty yawning caves, with some mine light glimmering faintly in the black interior.

When a shaft is sunk, tunnels called "drifts" and "crosscuts" are dug sidewise from it at different levels and in various directions into the mineral seam. Thus an elaborate mine is like an underground city, with an orderly arrangement of streets and alleys, though not all on one level. Some mountains, particularly in the western United States, are honeycombed with such underground workings. Where practicable these passageways are made to slope down a little toward the mouth of the tunnel or toward the central shaft so that the water may flow out of the tunnel, or water in the mine may drain into the sump or pool at the bottom of the main shaft, whence it is pumped out. The different levels of a mine are connected by auxiliary vertical shafts or "winzes." The ore between the various openings is said to be "blocked out." (*See* Copper for description of shaft and equipment.) Ventilation is accomplished in shallow mines by an air shaft. In deeper mines large rotary fans or blowers, driven by steam or electricity, are used to force fresh air into the far corners of the mines.

Mine buildings, constructed frequently of galvanized iron, with towering pipes and smokestacks, resemble great mills. A huge building is erected over the mine entrance in many cases. Often separate buildings are constructed for the mining machinery, engineers' offices, labor quarters, and explosives, etc.

Now let us visit a coal mine to see how it is worked, since coal mines have much in common with all underground mines. Unless the mine is lighted by electricity, the grimy miner wears attached to his small cap a little safety lamp, his only light in a world of blackness (*see* Lamps and Lighting). He is carried down into the depths of the pit by an elevator-like hoist called a "cage," passing the various levels just as you pass busy floors in a factory elevator. Following the main tunnel at the level on which he is to work he passes through a branching gallery until he reaches the black shiny wall of coal called the "working face." Then, perhaps lying on his side, he begins to break down the coal. He uses a pick, a shovel, a steel rock-drill—driven by steam, electricity, compressed air, or even a hand hammer—and various pneumatic or electric cutting and digging machines, such as the "undercutter," which undermines a ledge of coal by means of an endless chain in which knives travel around in a frame. Such machines are often mounted on rails, being moved along from place to place as the cutting proceeds.

The drill is employed chiefly in blasting. The miner drills small "bore holes" in the coal and inserts charges of black powder, which are touched off with an electric current. A muffled roar, and the coal in the face of the mine crumbles, the coal falling down in great chunks. As the coal is removed the mine roof is supported by leaving pillars of coal at intervals, or by using timbers, for one of the greatest of mine terrors is the danger of having the roof cave in. Accidents in which hundreds have been entombed alive are numerous. Extreme precautions against such accidents are now taken in all intelligent mining.

How the Coal Reaches the Surface

The miner next sorts the coal and loads it on small trams or dump cars on tracks. The cars are hauled to the main shaft by compressed air or electric locomotives, or by mules and horses, the animals being quartered in subterranean stables and living their entire life in the mine, rarely or never seeing daylight. In China, Mexico, and South America ore is still carried on men's backs.

Hoists, called "skips," convey the coal up the main shaft into the daylight. On the surface it is dumped down chutes into the "breakers"—an assemblage of inclined planes, screens, and chutes—which sort the coal into various sizes and grades. From the breakers the coal falls into bins or dumps and is ready to be taken to market.

In ore mines, other processes take the place of the coal breaking. In many cases the masses and lumps of ore, after being brought to the surface, are crushed, or even ground to powder, often by the pounding of huge hammers in a stamp mill. The valuable part of the ore is then separated from the waste, the process of separation being different in different cases. Where the ore is much heavier than the waste, the separation is brought about through differences in specific gravity. The final extraction of the metal, like the preliminary treatment of the ore, differs with the nature of the ore.

The importance of mining and the dangers threatening miners have led the United States to create

THE WEALTH UNCLE SAM DIGS FROM THE GROUND

So vast is the wealth which is annually produced in the mines of the United States that it is only with the help of the artist that the mind can begin to grasp it. By studying the details of this picture you will understand how great a part mining plays in the life of the nation, how many people depend upon it for a living, and what a vast enterprise it is to get this great supply of raw material out of the ground and to distribute it to the countless industries which depend upon the products of the mines.

a Bureau of Mines to study working methods and to train crews in methods of rescue. Much valuable work has already been done by the bureau.

Mining has been practiced in many lands for centuries. The Egyptians were the first miners, and the copper mines of Sinai, worked as early as 5000 B.C., are the most ancient mines of which history makes mention. Among the ancients mining was not regarded as honorable toil, and had to be performed by slaves; hence a nation had to become a conqueror before it could set up as a mine owner. There still exist the tunnels, furnaces, crucibles, and parts of tools of some of the ancient miners.

The work of utilizing the treasures of the earth's crust is hardly more than well begun. The mining of the future will undoubtedly surpass anything we yet know, and the demand for competent mining engineers and specialists will increase steadily. Such men are assured steady employment at good salaries, and success is likely to come earlier than in many other industries. Mining engineering requires perhaps a broader scheme of study than any other engineering course. There are about 45 schools in the United States which confer the degree of Engineer of Mines. A good course requires at least four years after the high school.

MINK. This little carnivorous animal, valued for its fur, is related to the weasel, but is stouter in the body and has a bushier tail, more like the marten. The European mink is a little smaller than the American mink, and is more northern in its range. The Siberian mink has fur of a clear tawny-brown color. The American mink is 15 or 20 inches long, with a tail of eight or nine inches, is yellowish-brown or dark-brown in color, with a white spot on the chin and sometimes on the chest. The darker the color, the more highly prized is the fur.

The mink is still found in wooded lands in widely scattered portions of North America. The darkest and most lustrous specimens are found in the regions farthest north, especially Nova Scotia. The mink lives along the banks of streams and ponds, like the muskrat, and hunts both in water and on land, either by night or day. He is a great nest-robber, being fond of birds, and he is a famous mouser. He also eats frogs, fish, lizards, grubs, etc.; and in winter he chases rabbits over the snowy ground. He can almost equal a fish in swimming, and on land he is wonderfully agile, and is well able to take care of himself. The mink's body is long and supple, and, notwithstanding his short legs, he can elude almost any pursuer, taking advantage of every hiding place, and disappearing as by magic. He can also climb like a squirrel.

The young begin life in a cozy home prepared in a hollow log or stump, hidden in tall growth near a stream, or the nest may be in a hole among rocks. Among the enemies of the mink are the owl, fox, wildcat, dog, and otter. When cornered, a full-grown mink is a foe to be reckoned with. Scientific name of American mink, *Mustela vison.*

MINNEAPOLIS, MINN. Its hundreds of great flour mills, with an output that in some years exceeds 18,000,000 barrels, have given Minneapolis the title "the world's miller" and have been the chief factor in making it the largest city of Minnesota and the Northwest. In addition to being the world's greatest flour-milling city, Minneapolis is also one of the chief primary wheat markets, and its towering elevators can store more than 50,000,000 bushels of this grain. St. Anthony Falls in the Mississippi River, reinforced by a system of locks and dams, furnishes power for the great flour mills, among which is the largest single mill in the world. The manufacture of lumber products, furniture, cooperage, breakfast foods, linseed oil products, agricultural implements, boots and shoes, clothing, underwear, and iron and steel products make Minneapolis one of the leading manufacturing cities in the country. It is fast taking the lead in the manufacture of prepared grain foods and tractors. It is the reserve city for Federal Reserve Bank District No. 9, which includes Montana, the two Dakotas, Minnesota, and parts of Wisconsin and Michigan. More than twenty railway lines enter ths city.

Minneapolis is also a "city of homes." The fine residences, the wide shaded streets, the extensive parks (covering one-tenth the area of the city), the numerous lakes connected by boulevards and waterways for small craft, and the healthful climate with its dry cold winters and mild summers, make the city a delightful place in which to live. One of the most interesting spots is Minnehaha Park, in which is found Minnehaha (Laughing Water) Falls, a silvery stream, immortalized by Longfellow, which dashes over a precipice into a shady glen 60 feet below. Lake Minnetonka, 17 miles southwest of the city, is one of the great summer resorts of the Northwest.

As a center of culture, Minneapolis has also attained distinction. It is the home of the University of Minnesota, one of the leading universities of the country, of several denominational institutions of learning, and of the Dunwoody Institute, a large endowed vocational school. The Institute of Art and the Thomas B. Walker Art Gallery contain collections which rank among the best in the country, and the Minneapolis Symphony Orchestra, maintained by public subscription, is known to music lovers throughout the United States.

The Falls of St. Anthony, to which Minneapolis is chiefly indebted for its prosperity, were discovered and named in 1680 by the Jesuit Missionary, Father Hennepin. The name Minneapolis comes from the Sioux word *Minne* (water) and the Greek word *polis* (city). For half its length on the east Minneapolis adjoins St. Paul. Population, about 381,000.

INEXHAUSTIBLE RICHES *of the* "GOPHER STATE"

MINNESOTA. Gold is precious, iron is priceless, but bread is indispensable. The world's greatest flour market is Minneapolis; some of the most productive wheat lands in the world lie in the Red River valley, which is partly in western Minnesota; and the most productive iron mines in the world are in the Mesabi Range in the northeastern corner of the state. So far as products go, the world needs Minnesota even more than Minnesota needs the rest of the world. True, the state has no coal, and its timber has been greatly reduced, so it depends largely on other regions for fuel. But its enormous resources in "white coal," or water-power, have been developed only to an insignificant degree, and it has vast supplies of peat capable of being used as fuel.

Extent.—North to south, 405 miles; east to west, 354 miles. Area, 84,287 square miles, of which 5,638 are water surface. Population (1920 census), 2,387,125.

Physical Features.—Northeastern boundary formed by Lake of the Woods, Rainy and Pigeon rivers; Red River, Lake Traverse, and Big Stone Lake on the western boundary; Mississippi River (rising in Lake Itasca), its tributary the St. Croix, and Lake Superior form the eastern boundary. Minnesota River, tributary to the Mississippi. Gently rolling surface broken by the Mesabi Range in the the northeast (about 2,200 feet) and "ten thousand lakes" (Mille Lac, Leech Lake, Red Lake, Vermilion Lake, etc.).

Principal Products.—Hay, corn, wheat, oats, potatoes, barley, rye; cattle and dairy products, horses, hogs; iron ore, stone and clay; flour and meal, packing house products, lumber and timber, iron and steel manufactures.

Chief Cites.—Minneapolis (about 381,000), St. Paul (capital, 235,000), Duluth (100,000), Winona, Hibbing, St. Cloud (all more than 15,000).

Neighboring states exceed Minnesota both in average and maximum elevation. Yet, long ago, angry volcanoes towered in this region, ever and again vomiting forth lava floods that spread for many a mile; the lava belched forth by Vesuvius is nothing to the lava-covered area of Minnesota. Battered and rasped for ages on ages by wind and rain and running water and slowly grinding glacier, only the flattened stumps of these ancient mountains now remain. Still, the highlands of the north-central part of Minnesota, seamed with volcanic rock, form a watershed whence water flows to the ends of the continent—into Hudson Bay through the tributaries of the Rainy River and the Red River of the North; into the Gulf of Mexico through the Mississippi and its tributaries; and into the Atlantic through the St. Louis River, the Great Lakes, and the St. Lawrence. From this forest-belted highland the rolling plain slopes in all directions, to be caught up again to higher elevations at two opposite corners, the Misquah Hills in the northeast and the Côteau des Prairies in the southwest.

In the Dakota Indian tongue, "Minnesota" is said to mean "clouded water." Set thick with thousands of lovely little lakes—more numerous, probably, than any other state can boast—and threaded with streams frolicking over many a waterfall, the state is like a water-soaked sponge. About one-fifth of the surface is swamp land, capable of being drained and exceedingly rich and productive after drainage. The annual rainfall is light, but owing to the amount of moisture in the soil and the fact that most rains occur when

A BEAUTIFUL DAUGHTER OF THE "FATHER OF WATERS"

Lake Pepin, thirty miles below St. Paul, is really only an expansion of the Mississippi across its flood plain. This great work of Nature's art was produced away back in the Ice Age when the Chippewa River, flowing into the Mississippi from the east, brought down loads of pebbles, sand, and bowlders from the melting glaciers, and poured them into the Mississippi. This checked the waters and caused them to widen out into this beautiful mirror of sky and clouds.

needed in the growing season, it is amply sufficient for splendid crops. Drouth is almost unknown. The expanse of water and the moisture in the soil modify to a certain extent the sudden violent changes in temperature, to which dry inland regions are subject. The snow that blankets the ground throughout the winter is an additional protection to the vegetation, which grows with marvelous rapidity in the spring.

Lakes, swamps, and the rich dark brown or black sandy soil itself are all a heritage from the great glaciers which, several times during the Ice Age, flowed over practically the whole of what is now the state of Minnesota. Here and there they scoured out basins for water to collect in, and everywhere they scattered the glacial drift. When the last glaciers began to retreat, their melting waters in the region of what is now the Red River valley formed a vast lake (called by geologists Lake Agassiz) greater than any of the Great Lakes of today. The alluvial mud left by this vanished lake is what makes this valley one of the world's granaries, containing the richest wheat lands of Minnesota, North Dakota, and Manitoba. (*See* Red River of the North.) In most years Minnesota's yield of spring wheat is surpassed only by that of North Dakota.

This is Folwell Hall of the University of Minnesota. The University has a central location on the banks of the Mississippi within the city limits of Minneapolis, and is an influential factor in American higher education. It also contributes powerfully to the welfare of the state by its training in the professions of agriculture and mining.

Corn is now the leading cereal in southern Minnesota. The two tiers of southern counties, it has been said, might be mis-

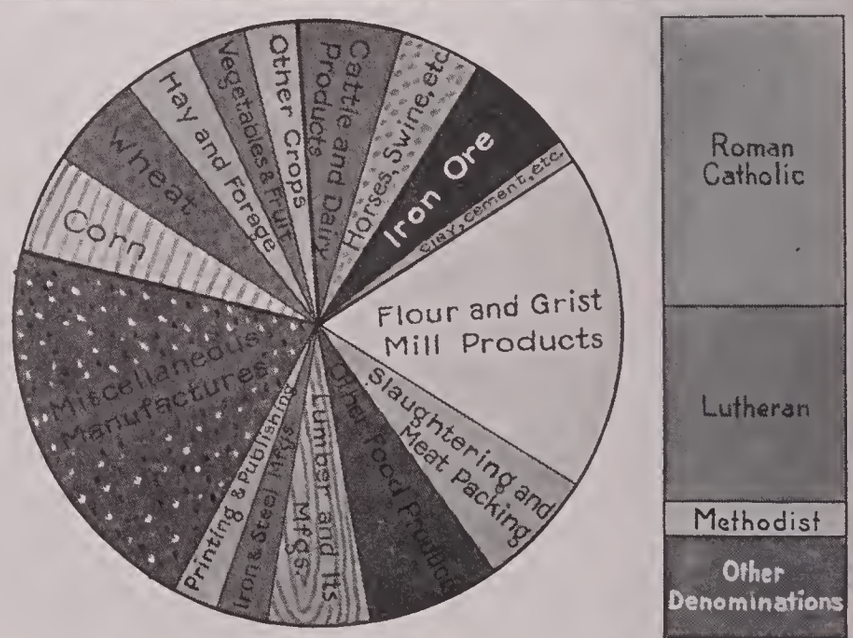
taken for Iowa. Potatoes are an important crop, especially in the central region which is also a great stock-raising and dairying section, giving Minnesota the title of the "Bread and Butter State." Minnesota ranks third, after North Dakota and Montana, in the production of flax (grown for the seed), chiefly in the northwestern part of the state. In northeastern Minnesota, where the development of lumbering and mining has exceeded that of agriculture, hay is the most important crop. All sections, however, practice diversified farming; and all the small grains, fodder and root crops, and most fruits are successfully grown.

The rugged northeastern part of the state contains the three famous iron ranges — the Vermilion, Mesabi, and Cuyuna—with about 175 mines. The ore is easily worked hematite; this is the most important part of the famous Lake Superior ore district, which is partly responsible for American supremacy in the world's iron and steel market. Some of the ore is worked up near Duluth, but most is shipped from there and other lake ports to the mills of Illinois, Ohio, and Pennsylvania (*see* Duluth). In some years more than 60 per cent of the ore mined in the United States has come from Minnesota. Nine-tenths of the output comes from the Mesabi range.

Building stones (granite, sandstone, and limestone) brick, clay, sand, and gravel are the only other minerals of commercial importance. The famous red pipestone—from which the Indians made their pipes—was quarried near the town of that name in the southwest corner of the state.

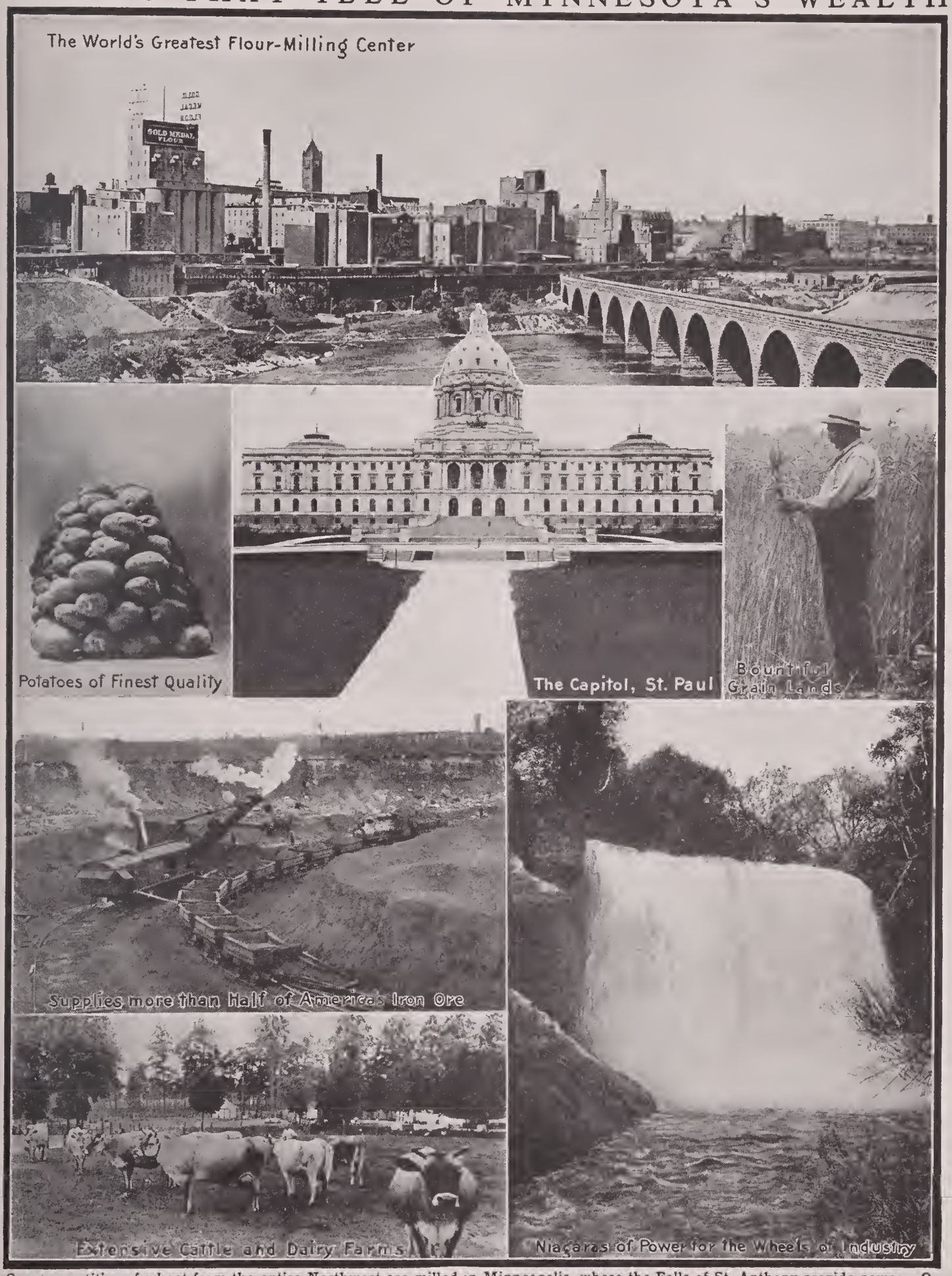
Water-power and raw materials produced within its borders — breadstuffs, live stock, timber, and iron ore—are the basis of the state's manufactures. Ever since Minneapolis became the world's greatest milling

THE STATE OF FLOUR, CATTLE, AND IRON



The "Twin Cities" of Minneapolis and St. Paul may be regarded as the neck of a funnel into which Nature pours a wealth of riches from the farm lands of the state. Notice how large a segment of the products chart is occupied by the various food manufactures.

SCENES THAT TELL OF MINNESOTA'S WEALTH



Great quantities of wheat from the entire Northwest are milled in Minneapolis, where the Falls of St. Anthony provide power. On the state's own farms, however, corn surpasses wheat in amount. Much of it is fed directly to the stock, particularly to the dairy cattle for which the state is famous. Iron ore, the great mineral product of Minnesota, lies in great beds so close to the surface that it is dug with steam shovels.

contained in the Easy Reference Fact-Index at the end of this work

THE "FLOUR CITY'S" WELCOMING GATEWAY

This colonnade stands in Gateway Park, Minneapolis. The park faces the Union Railway Station, and is the first thing travelers see on arriving. From behind it Nicollet and Hennepin avenues, the principal streets of the city, run through the business district.

center the state's chief manufactures have been flour and grist-mill products. St. Anthony Falls at Minneapolis, one of the most important single sources of water-power in the Middle West, was destined by Nature as the site of an important milling center; but other cities besides Minneapolis—Duluth, Winona, and smaller towns—have important mills (*see* Minneapolis). The second industry in importance, the slaughtering of cattle, sheep, and hogs, is centered at South St. Paul, which receives stock from Montana, Wyoming, and the Dakotas, as well as from within the state (*see* St. Paul). Lumbering and the manufacture of lumber products, once the most important of Minnesota's industries, has fallen to third place with the thinning out of the forests. The state is, however, protecting the timber that remains and reforesting much land unfit for farming. Lumber (chiefly white pine, spruce, and other soft woods) is manufactured in Minneapolis, Duluth, Virginia, and smaller places. Fur goods and shoes are manufactured chiefly in St. Paul. Iron and steel are manufactured near Duluth. Butter and cheese are produced commercially on a large scale. Rochester, Minn., the seat of the Mayo Clinic (now a part of the University of Minnesota), is as famous among the surgeons of the world as Minneapolis is among the millers.

More than 30 of the iron mines are located on state lands, and are leased to the operators. The royalties paid from mines on school lands, together with the sales of the lands and their timber products, have made the Minnesota school fund one of the richest in the Union, and permit the state to offer salaries to attract the best teachers. Hibbing, now a village of more than 15,000 (known in its early days

ONE OF SAINT PAUL'S BUSY STREETS

Here we see Seventh Street in Minnesota's capital. Minneapolis and St. Paul are really one city, so far as the visitor can see, but they guard their identities and, with good-natured rivalry, constantly strive to outdo each other.

AT THE GREAT ORE DOCKS OF DULUTH

In St. Louis Bay on Lake Superior the twin cities of Superior and Duluth have one of the finest natural harbors in the world. Here we are looking between two of the magnificently equipped ore docks at Duluth. These docks are required for handling the enormous shipments of iron ore from the rich Vermilion and Mesabi ranges. The switch tracks of the railroads from the mines extend out upon the docks. From the cars which you see, the ore is loaded directly into the vessels through those long chutes, which are lowered into the holds of the ore carriers.

as "the richest village on earth"), has schools costing half a million dollars. The state's leading institution of education is the University of Minnesota situated at Minneapolis.

Minnesota has a high proportion of foreign-born population for an agricultural state, mostly Scandinavians, Germans, Irish, and Canadians. These are all hardy, thrifty northern stocks, and they have contributed much to the state's prosperity.

Minnesota was first visited by Groseilliers and Radisson, French fur-traders, about 1660. The part of the state west of the Mississippi passed into the hands of the United States by the Louisiana purchase. The part east of the Mississippi had been ceded in 1763 by France to Great Britain and passed to the United States in 1783. Fort Snelling (at first Fort St. Anthony) was established in 1819 about six miles from where St. Paul now stands. The real beginning of settlement, however, did not come until after the treaties of 1837 with the Chippewa and Sioux Indians, which extinguished the Indian title to much of the land of the state. In 1849 Minnesota became a territory, in 1858 a state. In 1862 the Sioux Indians under Chief Little Crow attacked the settlements, killing 500 soldiers and civilians. They were defeated at Wood Lake on Sept. 22, and the following year were removed beyond the Missouri.

MINT. The fragrant herb we call mint preserves the name of the beautiful nymph Mintha. The goddess Persephone, so the old Greek myth runs, in a fit of jealous rage turned her beautiful rival into the plant which is now so highly prized for its odor and flavor. These qualities are due to essential oils secreted in little glands in the leaves, which when distilled give us the flavor used so largely in candy, chewing gums, perfumes, medicines, and cookery.

Many kinds of mint exist, 12 species growing in America. The most important of these are spearmint or garden mint, used in mint sauces and for flavoring chewing gum; peppermint, with which peppermint candy is flavored, and menthol prepared; pennyroyal, used in medicine; and bergamot, whose lemon-scented leaves give a fragrant oil much used in perfumes.

When the first flowers appear, the mint crop is ready to harvest. It is cut with scythes and mowing machines, cured like hay, and distilled with steam. Nearly one-half of the world's supply of peppermint and spearmint comes from southeastern Michigan. Other important mint fields are in northwestern Indiana; Wayne County, N.Y.; Mitcham, Surrey, and Lincolnshire, England; and Saxony, Germany.

Scientific name of spearmint, *Mentha spicata;* of peppermint, *Mentha piperita.* This genus of perennial herbs is distributed all over the world. All the species have creeping

rootstocks, square stems bearing opposite simple leaves, small purple, white, or pink flowers in whorls that often form terminal spikes. The mints belong to the family *Labiatae* or *Menthaceae*, which contains many other fragrant herbs such as sage, thyme, savory, marjoram, balm, lavender, rosemary, patchouli, and basil. Catnip or cat mint (*Nepeta cataria*), which cats eat with such relish and which is often steeped to make a medicinal beverage, also belongs to this family. All members of the mint family can be propagated by cuttings or by simply dividing the roots.

UNCLE SAM—*The World's Greatest* "MONEY MAKER"

A Visit to One of the Great Mints where Gold and Silver, Nickel and Copper Pieces are Stamped out by the Ton—The Huge Machines that Seize a Bar of Metal and Turn It into Clinking Coins

MINT, UNITED STATES. The process of making the gold, silver, nickel, copper, and bronze coins today is intricate and involves great skill and heavy machinery. In the United States there are three mints—the main one in Philadelphia, which turns out more coins than any other mint in the world; and two branch mints, in Denver and San Francisco, respectively. Their working capacity considerably exceeds the national demand, and so they also make coins for the governments of some other nations that do not have mints of their own. The United States mints also supply fine gold and silver in bars for industrial uses, and make assays of bullion and ores of the precious metals for private owners.

Let us visit the Philadelphia mint, since it is the largest and is typical of the others. It is a huge building with massive doors and mighty locks. It is patroled day and night by armed guards. After you have visited the museum containing a fine collection of ancient and modern coins, medals, and curios from many lands, a guide leads you through some of the ever-busy departments. You see the die-cutting department, which provides all the United States mints with the dies for stamping the designs on coins. In a branch of this department all medals of a national character—such as the Distinguished Service Cross—are manufactured. You will also get a glimpse of the 20 steel-lined vaults for the storage of coin and bullion. One has a floor space of 5,200 square feet and a storage capacity of 112,000,000 silver dollars—and it has often been filled almost to capacity with sacks of these coins! The doors of the vaults are thick and massive, and have special time-lock attachments. More than 3,250,000 pounds of steel enter into the construction of these vaults.

But the departments that will most interest you are those where the coins are made. If you own coinable gold in any form, of at least $100 in value, you may take it to a government mint or assay office and sell it at the fixed price of $20.67 per fine ounce. Silver is paid for in refined silver bars, which the depositor markets at the current price. You leave the metal at the counter in the weigh room, where it is carefully weighed and a receipt is issued. Then your metal is locked in a copper box and sent to the deposit melting room, where it is melted and cast in the form of a bar. Bits of this bar are assayed (*see* Assaying) to determine the degree of purity, and the depositor is paid upon the value thus determined.

Let us follow this bar and see how it is made into coins. First it is melted again and refined, to eliminate all foreign material and leave only the pure metal. Copper is added (in the proportion of one part of copper to nine of gold or silver) to give it the proper degree of hardness, and the melted metal is cast into ingots or bars of sizes suitable to the coins to be made. These are passed 18 or 20 times through hardened steel rollers, until they have been reduced to such thinness that a coin cut from the strip will be as nearly as possible the right weight.

The strips are now annealed or softened, so as to be workable. The coin strips are heated in a gas furnace until they become a uniform cherry red. They are then plunged into cold water, rolled once more to reduce them to uniform thickness, and then taken to the cutting machines. Each of these machines has a vertical punch which acts like a biscuit cutter, biting out about 225 coin blanks or "planchets" a minute.

The planchets are then inspected to eliminate imperfect pieces and "chips." Each gold piece is weighed by delicate automatic balances. If too light, they are tossed aside for remelting; if too heavy they are either filed off or remelted. The law allows a variation of one-half grain on double-eagles and eagles, one-quarter grain on half- and quarter-eagles, and 1½ grains on all silver coins.

In the milling room the edge of each piece is raised to protect the work on the completed stamped coin. The pieces are fed to the milling machine through an upright tube, and as they descend they are caught on the edge of a revolving wheel and carried about a quarter of a revolution, during which the edge is compressed and forced up to form a narrow rim.

The pieces are then annealed again, cleansed in an acid solution and dried. Now they are taken to the coining room and poured through feeding tubes into the coining presses, in which automatic fingers seize them and center them between two powerful dies, which are brought together with a pressure of 100 tons to the square inch. Thus they are stamped in a single operation with the designs on both sides. The "milling" is completed by cutting grooves in the edge so as to make stealing of the metal by clipping or filing easy of detection. The finished coins are delivered from the machines into a pan below at the rate of 80 to 120 a minute.

Each coin is separately inspected, and weighed in automatic machines. Finally the coins are counted

by weight, and made into bundles of $5,000 each (if gold) and $1,000 each (if silver). These are delivered in canvas bags to the superintendent of the mint, who keeps them stored in the vaults until they are ready to be sent out, to find their ways into the pocketbooks of the country.

In the circulation of small coins from hand to hand, the friction gradually wears the impression off and reduces the weight. Hence the point at which coins lose their legal validity is fixed by law. In the United States gold coins which have lost more than one-half of one per cent of their weight in 20 years from date of issue, or proportional amounts for less periods, are legal tender only by weight.

The United States mint was established by Act of Congress, April 2, 1792. It remained an independent department of the government until 1873, when it was reorganized as a branch of the Treasury Department. The first money made by the United States mint consisted of copper pennies, coined in 1793. Silver dollars were next made (1794), and gold eagles ($10 pieces) next (1795). The largest gold pieces ever coined were 600 $50 pieces coined as mementoes of the Panama-Pacific International Exposition. (*See* Money.)

MIRABEAU (*mē-rä-bō'*), COUNT (1749–1791). To the noblemen of France, in 1789, the brilliant but dissolute Honoré Gabriel Riquette Mirabeau must have seemed a traitor to their class, for in the Estates-General of that year, to which he was elected, he acted as a leader of the Third Estate, or common people. But Mirabeau had learned by personal experience something of the evils of the old government; and when the nobility refused to elect him as a representative, he turned to the Third Estate, that he might not be deprived of helping in the changes so badly needed.

Mirabeau's father, an eccentric nobleman, heartily disliked him because of his ugly face, scarred by smallpox, and the wild life of his youth. Several times the father had secured from the king orders for the imprisonment of his wayward son, possibly to keep him out of mischief, and one of Mirabeau's first writings was against these arbitrary arrests by *lettres de cachet.*

In the Estates-General, Mirabeau first attracted attention by openly defying the king. Louis XVI had sent a command to the members of the Third Estate for them to retire from the hall in which they were sitting to their old separate place of meeting. But Mirabeau replied to the messenger: "Go tell your master that we are here by the will of the people, and that we shall be removed only at the point of the bayonet." From this time his influence in the assembly was great. His fire and dash, and his stirring words, won for him the titles of the "Tribune of the People" and the "French Demosthenes."

His statesmanship, however, saw clearly the dangerous direction in which the Revolution was going. In order to save the country from impending disasters, he undertook secretly to advise the king with counsels of moderation. But the king and queen detested Mirabeau because of his former life and because he took money for his advice, and they refused to be guided by his counsels. Thus his attempt to establish a constitutional monarchy, such as England had, failed. He was elected president of the famous "Jacobin Club" in 1790, and shortly afterward president of the National Assembly.

At length, worn out by his work and his dissipations, Mirabeau died in 1791. His death removed the only statesman who could have guided the Revolution through the coming troublous times, a fact which Mirabeau clearly recognized when he exclaimed just before his death: "I carry with me the ruin of the French monarchy."

MIRACLE-PLAYS. In the Catholic church the celebration of the Mass and the special services for the festivals have many dramatic elements. In the Middle Ages these services were made more popular and more instructive by the use of living pictures, or tableaux,—as, for instance, the representation of the Child in the Manger surrounded by the Wise Men. It was a natural step from tableau to acting, first in dumb show, and then with appropriate songs and dialogues. This was the origin of the "mysteries" and "miracle-plays." As far back as the 10th century we find simple plays of this kind, though the earliest play mentioned by the name is the 'Play of St. Katherine' produced in England in the 12th century.

At first the language used was Latin, but later this was changed to the language of the people—English or French or German, as the case might be. As the plays grew in length and elaborateness, they were transferred from the church to the churchyard, and then to the village streets. Once outside the church, secular and comic elements were added. In the 13th century these plays came little by little to be taken from the hands of the clergy, and by the latter part of the 14th century they were acted almost entirely by the different guilds, or unions of craftsmen. These companies went from town to town with large wagons, called "pageants," on which they set up a stage with rude scenery. The Creation, Noah and the Flood, Adam and Eve, Abraham and Isaac, and other stories of the Old Testament were presented, as well as incidents in the life of Christ. Strictly speaking, these representations of stories from the Bible were the mysteries, while the miracle-plays dealt with the lives of the saints, but this distinction was not always observed. Closely associated with these plays were the *moralities,* in which moral lessons were taught by representing virtues and vices as persons. One of these old plays, entitled 'Everyman', has been recently revived.

Most of these plays, which originated as a means of religious and moral instruction, became so corrupted by jests and vulgarities that they were condemned by the church, and after the 15th century almost ceased to be given. But the pure type of mystery is still preserved in the beautiful Passion Play, which is presented once in every ten years in Oberammergau in upper Bavaria. (*See* Drama.)

SEEING SHIPS SAILING THROUGH THE CLOUDS

Why do we sometimes see mirages of huge ghostly ships sailing across the sky? The question puzzled men for centuries but now we have an answer. Somewhere above the ship is a layer of heated air. The lower side of this layer acts as a mirror and reflects the image of the ship below, so that the light rays seem to be coming from somewhere in the sky. If there are several layers, more than one image may be produced.

Mirage (*mē-räzh'*). Travelers over burning desert sands sometimes think themselves nearing an oasis because they see in the distance green palms growing about cool water. They urge their camels forward only to find that the vision fades before their eyes, for it is only a reflection, or air picture, of an oasis far away below the horizon. They have seen a mirage.

To understand the cause of a mirage it must be remembered that we see an object by rays of light reflected from it to our eyes, and in the straight line in which the rays enter the eye. Ordinarily these rays come to the eye in straight lines from the object and we see only objects above our horizon. Now in the case of a desert mirage the rays of light passing upward from an object below the horizon are reflected back from a layer of denser air above the hot light air next the sand. This higher layer of dense air acts as a mirror and, being above the object it reflects, this object appears above the horizon and in the sight range of the traveler, when in reality the object

THE HEART-BREAKING VISION IN THE DESERT

Who has not heard of thirst-maddened travelers in the Sahara suddenly seeing a tempting vision of a cool oasis, which vanishes at their approach? Usually the mirage is accompanied by an inverted duplicate, which looks as though it were mirrored in the sand. Desert mirages are the reverse of ocean mirages, being caused by the reflection from a layer of cool air above the hot surface air.

For any subject not found in its alphabetical place see information

itself is miles away and out of sight. But this is not all, for the air layers vary in density and sometimes reflect a double image, one upside down.

In the ocean mirage a vessel below the horizon is plainly reflected in the upper air. A most remarkable ocean mirage was seen in 1854 on the Baltic, when the English fleet of 19 vessels 30 miles away was distinctly seen floating in the air. The case of the ocean mirage, which occurs in the cold northern waters, is just the opposite of the desert mirage, for the cool dense air is close to the water and the reflection is caused by a warmer layer of air above it.

Still another form of mirage is known as "looming." In this the objects seen are magnified and sometimes, when the sun is in just the right position and the sea and the air help, are set against a background of colored mists. This form of mirage is common in the straits of Messina. People of Reggia, looking toward Sicily, may see castles, trees, and men suspended above the sea. This vision is a reflection of the city of Messina, though for long years it was thought to be a city of fairy castles and so was given the name "Fata Morgana," by which name it is still known.

Mirrors. In prehistoric times the only mirrors were pools or lakes. Later highly polished metal mirrors were made, such as the bronze mirrors of the Egyptians, Greeks, and Romans, and the mirrors of the modern Japanese. Similar to these were the unbreakable "trench mirrors" used in the World War. Not until the 13th century were mirrors of glass with backs of lead or tin manufactured. In the 17th century the Venetians made a vast improvement by mixing mercury with the tin for the reflecting surface. Although the mercury fumes killed many workmen, and weeks were required to complete a mirror, the method was in common use until about 1855, when the modern process of backing mirrors with nitrate of silver was patented. The mercury process is still occasionally used for cheaper mirrors.

Today a mirror of any size can be made in about an hour. For the best mirrors, plate glass about a quarter of an inch thick is used. This is cut to the proper size with a diamond-pointed instrument. Then it is beveled with sand and water in a "roughing mill," polished on emery wheels, and smoothed with fine sandstone and buffers of thick felt covered with rouge. Next, in the silvering department, it is cleansed and placed on heated and blanketed tables. A diluted compound of nitrate of silver, ammonia, and tartaric acid is poured over it, the heat from the table helping the silver to adhere to the glass. The silver back is dried, and then shellacked or painted. Silvered mirrors reflect 20 to 25 per cent more of light than those backed with mercury.

In the ordinary flat surface or plane mirror, your image appears erect, and as far behind the mirror as you are in front of it. But for scientific and other purposes curved mirrors are often made—convex, concave, etc. Curved mirrors reflect distorted images, and so are often seen in amusement halls and parks. When you look into a concave cylindrical mirror you see yourself as very tall and lean, while a convex mirror makes you look shorter and fatter than any little brownie.

The mirror-making industry is of great importance in both Europe and the United States. In the latter country it is centered in Chicago, whence mirrors are shipped to Canada, Mexico, South America, and other foreign as well as domestic points.

THE BAYOU STATE *and its Cotton, Corn, and Timber*

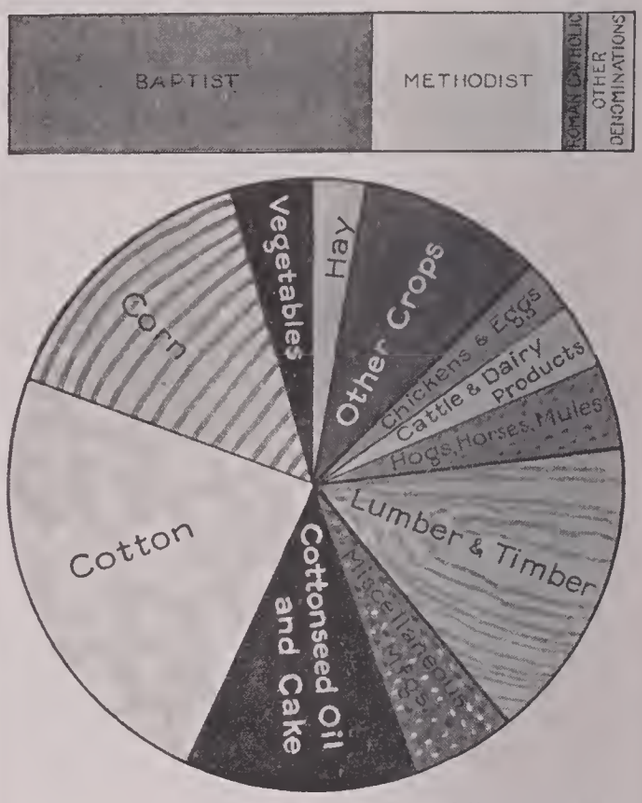
Extent.—North to south, 330 miles; east to west, 188 miles. Area 46,865 square miles. Population (1920 census), 1,790,618.
Physical Features.—Surface low, flat, and in places swampy (highest point, about 1,000 feet); eastern rivers flow into the Gulf of Mexico; western streams flow into the Mississippi River. Principal rivers: Mississippi (western boundary) and its tributaries the Yazoo and Big Black; Pearl, Pascagoula, and Tombigbee.
Products.—Cotton, corn, hay, sweet potatoes, sorghum, and sugar cane; live stock; fish; lumber, turpentine, etc.; cotton-seed oil and cake.
Chief Cities.—Meridian (about 24,000), Jackson (capital, 23,000), Vicksburg (18,000).

Mississippi. If Mississippi has few manufactures and no cities of more than 25,000 people, it possesses farming sections so rich that it has been called "the Cream Jug of the Continent." Reaching from Tennessee to the Gulf of Mexico, it lies in the latitude of the greatest variety of products and the greatest fruitfulness—a temperate zone bordering on the semi-tropics, with mild winters and hot summers. Its surface is for the most part level, with a rolling or hilly section in the northeast and some slightly elevated land in the southeast. About half the total area is still covered with virgin forests of valuable hardwoods, cypress, and yellow pine, whose products represent a large part of the state's manufactures. There are over 100 species of forest trees, including 15 species of oak. On the river bottoms and in swamps cypress predominates, and in the southern part of the state, long-leaf and short-leaf pine.

A broad low ridge broken by narrow valleys separates the Mississippi basin from the region whose rivers flow directly into the Gulf of Mexico. Eastward lie rolling grassy prairies with a few low hills in the northeast, and in the southeast, between Pearl River and the Alabama line, marshes bordered on the Gulf side by a white sandy beach and fringed with islands. Westward of the low watershed are the swampy flood plains of the Mississippi and its affluents, especially the Yazoo. The famous "Yazoo delta" formerly subject to overflow is still meshed and fretted with meandering and interlacing channels and "oxbow" lakes running off from the great river.

Nature does not know how to compound a more fertile soil than that of the Yazoo-Mississippi region,

A STATE RICH WITH FARMS AND FORESTS



In the Yazoo Basin, built up by the Mississippi and Yazoo rivers, Mississippi possesses one of the richest soils in the world. The district along the Alabama border produces cotton, and truck growing prospers along the Gulf coast. The largest city and chief manufacturing center is Meridian. Above we see the relative value of the state's products and the relative strength of the leading religious denominations.

built up through the ages in layers of richness by the Mississippi's floods. It covers a strip of about 7,000 square miles between the Mississippi and the Yazoo rivers, lying so low that a continuous line of dikes is necessary to protect it from the waters. For more than a century this region has been famous for its fine long-staple cotton, which was for years the sole crop. But the ravages of the boll-weevil have made crop rotation necessary, and now corn, soy beans, velvet beans, alfalfa, and other forage crops are extensively grown. There are probably few regions better adapted to stock raising, which is a growing industry. Most of the land is held in large plantations owned by whites and worked chiefly by negroes. The black soil prairies of the northeast, the brown loam and loess of the west, and the smaller river valleys are scarcely less fertile.

Cotton is also grown in large quantities on the Alabama border, and there is indeed hardly a county which does not contribute to this chief crop of the state. Corn is next in importance. Sweet potatoes are everywhere grown, taking third place in some years. Sugar cane makes a good crop in some places, oats and wheat are grown in the northeast quarter, and rice in the southwest. "Truck" crops of all kinds and all the fruits of temperate climes thrive here, and are sent to the markets of the north by the trainload. For years the cultivated pecan trees in the southern part have supplied the market with the highest quality of large "paper-shell" pecans.

One reason for the success of agriculture is the abundance of water. The atmosphere is humid, the rainfall ample, and the streams never failing. In addition, large numbers of artesian wells furnish pure drinking water, an important factor in promoting the general health.

Good water supply and good pasturage for nine or ten months of the year make a combination favorable to beef production and dairying. "Scrub" cattle and "razor-back" hogs have largely been eliminated from Mississippi farms. Beef, pork, and butter are now produced from high-grade stock. Sheep are grazed on the "cut-over" timber lands.

The coöperative system is much used in marketing farm produce. Improved roads are another aid to successful marketing and profitable farming; several thousand miles of good gravel highways have been constructed in recent years.

Second to agriculture in importance are the industries connected with lumber. Hundreds of sawmills turn large quantities of timber into lumber each year,

For any subject not found in its alphabetical place see information

RICH FARMS AND PASTURE LANDS

Here is a cutting of alfalfa from a field in the rich delta land adjoining the Yazoo and Mississippi rivers. This land, formed originally by mud carried by the Mississippi from more northern regions, and deposited during the overflows, is said to be unsurpassed in richness, exceeding even that in the world-famous valley of the Nile. The region produces other crops in abundance, and has long been famous as one of the greatest cotton-growing districts in the world. The increase in the number of small farms and the diversification of crops have added greatly to the value of its products, and thereby to the wealth of the state.

This view is typical of another phase of Mississippi. Against a background of trees, such as those which cover the greater part of the state, is a herd of Holstein cattle. Mississippi's dairy cattle have increased greatly in number in recent years, and dairy products are becoming increasingly important in the list of the state's industries.

contained in the Easy Reference Fact-Index at the end of this work

MISSISSIPPI'S CAPITOL AT JACKSON

The new State Capitol was finished in 1903. The older building which it replaced was of considerable historical interest, for it had been in service since 1839 and had seen many stirring events.

and charcoal, tar, creosote, and turpentine are manufactured as by-products from the pine stumps and waste limbs. Some paper is also made. Cotton-seed oil, oil cake, cotton goods, and fertilizers are other manufactures of importance. The fishing industry is growing steadily. Considerable quantities of oysters and shrimps are shipped annually from Biloxi on the Gulf of Mexico. Mineral waters and clay are widely distributed. Brick, tile, terra cotta, etc., are produced in large quantities. Deposits of lignite (a low grade of coal), limestones, and other building stones are awaiting development.

The cities have little more than 10 per cent of the population. The largest and chief manufacturing city is Meridian, in the east central part of the state. Jackson, the capital, is a commercial center for a large agricultural section. Vicksburg, attractively situated on the Mississippi River, has some manufactures and is noted for its cotton trade. Natchez also is an important cotton shipping port. The coast towns are noted as winter resorts, particularly Biloxi, Pass Christian, and Ocean Springs. The University of Mississippi, situated at Oxford, was opened in 1848. An agricultural college and several experiment stations are maintained by the state.

FROM MISSISSIPPI FARMS

The pecan nut in the upper corner is a leading Mississippi product. Cotton, corn, and garden truck are other important sources of wealth.

The first European to pass through what is now the state of Mississippi was the Spanish explorer De Soto, in 1539. La Salle took possession of the country in the name of France in 1682, as a part of Louisiana. Early in the 18th century forts were built on the bay of Biloxi and at Natchez. Part of Mississippi was ceded to Great Britain in 1763 and passed to the United States with the treaty of 1783, which recognized the independence of the new republic. Spain's claim to the remainder of the state was surrendered in 1795. The state was organized as a territory in 1798, and came into the Union in 1817. During the Civil War, Mississippi suffered greatly, a large part of the state being devastated by the contending armies (*see* Vicksburg, Battle of). The state was readmitted into the Union in 1870. From 1870 to 1875 it was under the control of a "carpetbag" régime. In 1875 the Democrats obtained control, and the governor, lieutenant-governor, and superintendent of education (the first a white man, the other two negroes) were driven from office by impeachment or threats of impeachment. The present constitution, adopted in 1890, aims to preserve "white supremacy" by requiring that the voter be able either to read any clause in the Constitution or to interpret it when read.

The MIGHTY "FATHER of WATERS"

A View of the Mississippi from the Bluffs near Red Wing, Minnesota

MISSISSIPPI RIVER. The Mississippi River, the "Father of Waters," is the greatest river in North America and one of the largest in the world. If we consider the headwaters of the Missouri as its real source, it is the longest river in the world—4,200 miles—and in its lower course it is one of the crookedest. It lies entirely within the boundaries of the United States. Its basin, which extends from western Pennsylvania to Idaho, embraces two-fifths of the United States, and is second in size only to the valley of the mighty Amazon. The greater part of this vast region is enormously fertile, which, combined with the latitude, elevation, and rainfall, makes of the Mississippi valley an ideal dwelling place for man, not excelled anywhere on earth. Fifty million people dwell in the states drained by this mighty river, which comprises an area equal to half of Europe.

Early Spanish explorers in the Gulf of Mexico had noted the mouth of this great river and named it the "River of the Holy Ghost." But Hernando De Soto is usually considered its discoverer, for he not only encountered its widely muddy stream in his explorations in 1541, but died upon its banks and was buried in it, leaving his party to float down the great river to the Gulf of Mexico, to escape the hostile Indians. More than a hundred years passed before other white men saw it, when (in 1673) the brave and determined Frenchmen, Marquette and Joliet, descended it as far as the mouth of the Arkansas River. It remained for La Salle and his party, in 1681, to follow the river to the Gulf. Starting from the headwaters of the Illinois River, they pushed their intrepid way first through floating ice and then down the mighty stream, past the mouths of the Missouri and the Ohio, down the great bends lined on either side with dense forests, through the marshy delta, with its three branches, until they reached the Gulf—"lonely as when born of chaos, without a sail, without a sign of life." A few years later Louis Hennepin, sent by La Salle, explored the upper river from the mouth of the Illinois to the Falls of St. Anthony, where Minneapolis now stands. Not until another hundred years had passed, in 1832, did Henry Schoolcraft follow the Mississippi proper to its source in Itasca Lake, in Minnesota.

As it issues from the cool clear waters of Lake Itasca, the Mississippi is only a little stream, 10 or 12 feet wide, and about two feet deep. For a time it rushes north, over rapids and around bowlders, with reed, flags, and watergrass growing profusely on its banks and in its crystal waters. After much twisting and turning, it settles into its southeasterly flow. Tributaries join it, often as large as the river itself, until it reaches a width of 1,200 feet at the Falls of St. Anthony. Here the river descends about 65 feet in three-quarters of a mile, forming rapids, in the midst of which rears a precipice 18 feet high over which the river once plunged in a beautiful cataract. Now this water-power has been used to build up the manufacturing interests of Minneapolis.

The banks of the stream presently rise in rocky bluffs, sometimes as high as 500 feet, and continuing almost to the junction of the Ohio River. The distance between the two lines of bluffs varies from

three to eight miles, and the river wanders back and forth between them sometimes touching one side, sometimes the other. Along most of the way the centuries have built up gentle slopes at the foot of these bluffs, covered with trees and grass to the water's edge; but here and there the cliffs rise straight up from the water in great towering palisades of rugged beauty. Where the Chippewa River flows into the Mississippi, 77 miles below St. Paul, the river spreads out over the entire valley, forming beautiful Lake Pepin, 25 miles long and two to three miles wide.

The Ancient Mississippi and the Vanished Sea

At Cape Girardeau, 38 miles above the mouth of the Ohio, the bluffs cease and the great alluvial valley, which the river has built, begins. Long ago an ancient gulf extended up as far as the lower edge of the bluffs, and just as the Mississippi now pours its silt-laden stream into the Gulf of Mexico, in these early days it poured it into this sea, gradually filling it up until it has built for itself a vast valley of soil as fertile as the valley of the Nile and four times as large. In the 200 years of which we have a record, this mighty river has extended the land area only about a third of a mile, so you can see what an immense amount of time has been needed for this larger task.

In the lower bottomlands of the Mississippi there is a strange condition—the surface of the surrounding country is usually lower than the surface of the water. As the river flows in its channel, it deposits sediment on the bottom and at the sides all the time, thus building up the bed of the river so that the stream would overflow were it not for the fact that the same process is also constantly elevating the banks. The result is that the Mississippi flows down to the Gulf on a broad ridge which it has built above the surrounding land. Finally it enters the Gulf of Mexico through the delta—a marshy impassable area of more than 12,000 square miles, with its three great arms or passes known as the Southwest Pass, the South Pass (with two subdivisions near the Gulf), and an eastern arm dividing into North Pass and Pass à L'Outre.

These alluvial bottoms, however, do not entirely fill the space between the mouth of the Ohio and the Gulf. On the east bank there are high spots of solid ground, which were capes and peninsulas on the ancient ocean. Towns have been built on many of these high places—at Columbus (Ky.), Randolph and Memphis (Tenn.), Vicksburg and Natchez (Miss.), and Baton Rouge (La.).

Vast Drainage Basin of the Mississippi

The character of the Mississippi as a clear placid northern river does not change until the great Missouri pours its red-mud torrent into it just above St. Louis. In high water this stream has a volume greater than that of the Mississippi itself, and for miles the waters of the two rivers flow along side by side without mixing. A little farther on the Ohio brings down from the Alleghenies a volume of water two-thirds as great as the other two combined. Altogether there are in the Mississippi system 250 tributaries and their branches, making 14,000 miles of navigable water and a drainage basin of 1,240,050 square miles.

Between St. Paul and the mouth of the Red River, the southernmost of its tributaries, there are about 750 islands large enough to be given a name or a number. The lower ones are covered with willows and the higher ones with cottonwood, maples, and oaks. Some of the latter have been cleared for cultivation. There are but three islands from the mouth of Red River to the Gulf, and except for these the river sweeps along majestically in a single deep channel.

One of the most remarkable things about this river is the tendency it has to shorten its length. In the lower courses it flows in great bends and curves, in one instance taking 1,300 miles to cover a distance of 675 miles "as the crow flies." In these bends the current has the tendency to cut into the concave bank, and build out the convex, so that the neck of the bend gets gradually smaller and smaller, until finally the river breaks through in a "cut-off," leaving a crescent-shaped lake as the only remembrance that the great river once flowed in another bed. There are great numbers of such lakes along the river, particularly from Memphis to the mouth of the Red River.

Damage Done by the Annual Floods

Floods occur on the Mississippi almost every year, usually in the spring when melting snows and spring rains swell the tributaries and the waters come down in a great torrent which brings disaster to vast stretches of lowland along its lower course. In the great flood of 1882 the river was 70 miles wide in some places. One of the greatest and most destructive floods occurred in 1913, when nearly $42,000,000 worth of property was destroyed and many lives were lost. The Ohio River rose 21 feet in a single day.

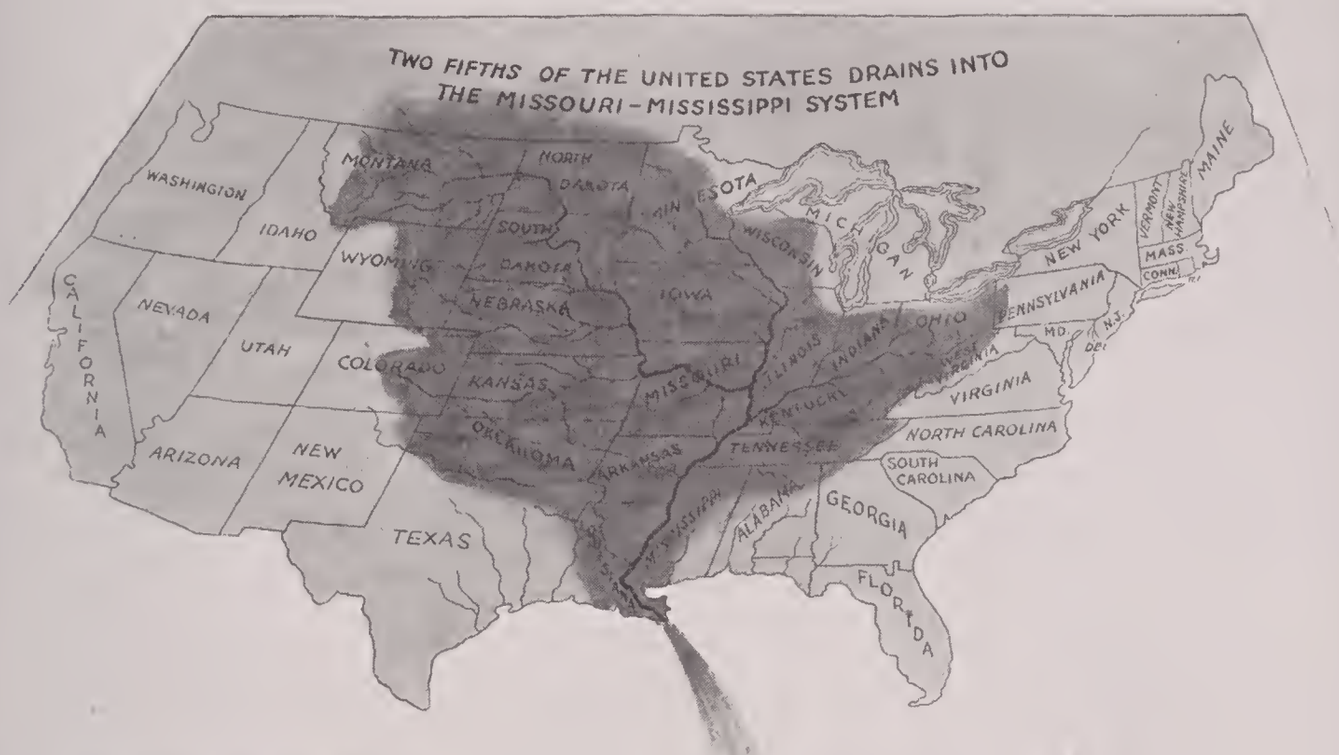
There are great variations in the river's width and depth. At the junction of the Illinois it is about 1,400 feet wide, and after the Missouri flows into it the ordinary width is sometimes as great as 7,000 feet. In the lower valley the channel narrows and it maintains a general width of about 3,000 feet. In some places the river is very shallow, but below New Orleans the depth is from 30 to 62 feet. The volume of water poured into the Gulf by this great stream is reckoned at 670,000 cubic feet a second and the new soil deposited in the Gulf in an average year would cover 270 square miles to a depth of one foot.

Near the headwaters there is a series of lakes which have been dammed by the Government to create a system of storage reservoirs. These are opened in low water, to increase the depth of the upper river so it may be sufficient for navigation. These reservoirs constitute the largest system of the kind in the world.

There are two great objects in the improvements of the river: to provide a permanent channel of sufficient depth for navigation in low water, and to protect from

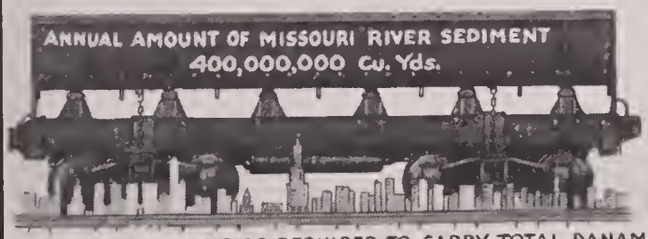
WHY THE MISSISSIPPI IS THE "FATHER OF WATERS"

NORTH AMERICA	MISSOURI — MISSISSIPPI	4200 MILES
SOUTH AMERICA	AMAZON	4000 MILES
AFRICA	NILE	4000 MILES
ASIA	OB	2500 MILES
EUROPE	VOLGA	2325 MILES



MISSISSIPPI'S MAXIMUM DISCHARGE EACH MINUTE WOULD FILL A BARREL OF 138,000,000 CUBIC-FOOT CAPACITY

NIAGARA



MISSISSIPPI NORMAL

RELATIVE SIZE OF CARS REQUIRED TO CARRY TOTAL PANAMA EXCAVATION AND ANNUAL MISSOURI RIVER SEDIMENT

MISSISSIPPI IN FLOOD EQUALS 8 NIAGARAS

contained in the Easy Reference Fact-Index at the end of this work

overflow the low lands along the banks. The great difficulty to overcome has been the caving banks. From Cairo to Red River, especially, caving is going on all the time. In an attempt to stop this caving, facings of stone and brush have been put in almost the entire length of the course, which by confining the flow impel the river to scour out a deeper channel. Below the water's edge the sloping bank is also protected with "mattresses" made of willow brush.

The United States Government keeps a fleet of dredges on the river and its tributaries, to dredge out the sand where the channel threatens to become shallow; and "snag boats" patrol the river during navigation to remove snags that would imperil navigation. The object is to maintain a navigable channel not less than 250 feet in width and 9 feet in depth.

The Great Levee System

From Memphis to the sea the river is confined within a levee system, the most extensive work of its kind in the world. There are about 1,570 miles in the present system, of which all but 70 miles have been constructed since 1905. The first levee was built at New Orleans early in the 18th century, to protect that new little settlement from the floods. Several plantation owners built rude dikes to protect their lands, and a little later the states of Louisiana and Mississippi took up the work of protecting the lowlands. During the Civil War the levees were neglected and bad breaks occurred. The work was not actively resumed until 1882, when the United States Government began its coöperation. The standard levee has a top width of eight feet and is 150 feet or more at the bottom; the height varies from 15 to 25 feet, decreasing to 10 feet near the Gulf and increasing to 30 feet where old "sloughs," or abandoned channels, are crossed. The levees are made of earth, thickly sown with Bermuda grass. In moderate flood years these levees afford adequate protection, but when an unusual flood occurs, breaks and "crevasses" appear. Jetties for deepening the channel have been constructed, especially in the region of the "Passes."

In the upper reaches of the Mississippi, where there is a considerable fall of water over a short distance, several great power dams have been erected. The first of these is at Bemidji, 32 miles below Lake Itasca; and there are others at Grand Rapids and Brainerd. From Brainerd to Minneapolis, where the river has a fall of 444 feet in 150 miles, there are six of these immense plants. The United States Government in 1914 built a large lock and power dam between Minneapolis and St. Paul; and at Keokuk there is a magnificent concrete dam, which has changed the Des Moines Rapids into a beautiful artificial lake.

From the beginning of the 18th century until the building of the first railways, in the middle decades of the 19th century, the Mississippi River furnished practically the only means of communication in this great region. At first the whole commerce was carried on by flatboats ("broadhorns" and barges) and keel boats. These floated downstream with their cargoes of pork, corn, flour, whisky, hides, and staves to New Orleans where the boats were either sold for lumber or changed cargoes and were tediously "warped" or poled back against the current. It sometimes took nine months to go down and back. The business increased to such an extent in time that it gave employment to hordes of brave hardy men. Four years after Robert Fulton ran the first successful steamboat on the Hudson River a steamboat was built at Pittsburgh, which descended the Mississippi to New Orleans. In January 1834, an official list gave a total of 230 steamboats and 4,000 flatboats operating on the river; and besides these there were great lumber rafts, sometimes an acre or more in extent. In the great days of steamboating, about the year 1853, when the Mississippi and its tributaries were alive with river craft, 3,307 steamboats landed at St. Louis, exclusive of a daily packet to Alton. The transportation of coal on the Ohio began in the early 40's and soon developed into a great business. There were skins and lumber from the north, grains and other products from the central region, and coal from the Ohio regions, while the south sent back cotton, sugar, molasses, and miscellaneous freight. Along the banks cities grew rapidly, among them Minneapolis, St. Paul, Winona, Keokuk, Dubuque, Davenport, Rock Island, Burlington, Quincy, St. Louis, Cairo, Memphis, Baton Rouge, and New Orleans. The life of a steamboat man in those days was romantic, and frequently beset with perils, as many boats were lost. Mark Twain spent part of his life as a pilot on the river during these great days, and has written of it in his interesting book, 'Life on the Mississippi'.

The Decline of the River Boats

With the Civil War this prosperous period ended. The dangers of the river travel increased through neglect, the trend of settlement was strongly toward the west, turning the steamboat traffic to the Missouri, and the building of the great transcontinental railroads gave formidable competitors to happy-go-lucky steamboat owners. Today only about 700 steamboats land in a year at St. Louis, the great central river port. The increased mileage and the efficiency of the railroads, the better terminal facilities offered by them, coupled with the uncertainty of the rates and the irregularity of river transportation, all contributed to the decline of river transportation. But in general appearance, the boats on the river today have changed little since the days when steamboat traffic was at its height, although there have been several mechanical improvements, and coal is now used instead of wood.

Marked progress is being made in the effort to revive the river traffic. Many of the cities are building better terminal docks, and companies have been formed to finance the building of boats and barges, and a deep waterway project promises to open a passage from the Great Lakes to the Gulf. So the great river may once more return to its place as one of the nation's great arteries of commerce.

For any subject not found in its alphabetical place see information

MISSOURI'S FERTILE FARMS *and* METAL-VEINED HILLS

A Picturesque Valley among the Wooded Slopes of the Ozarks in Southern Missouri

Extent.—North to south, 283 miles (counting southeastern projection, 328 miles); east to west, 310 miles. Area, 69,420 square miles. Population (1920 census), 3,404,055.

Physical Features.—Prairie plains in north and west, rising toward the west to an elevation of about 1,000 feet. Forested Ozark Plateau in the south (highest point, about 1,800 feet), and fertile lowlands in the extreme southeast. Principal rivers: Mississippi (eastern border) and Missouri, Osage and Gasconade flowing into the Missouri and Meramec into the Mississippi from the south; Platte, Grand, and Chariton flowing into the Missouri from the north.

Products.—Corn, hay, wheat, oats, potatoes, cotton, sorghum, flax, tobacco; apples and peaches; mules, horses, and other live stock; zinc, lead, coal, portland cement; packing-house products, flour and other food products, boots and shoes, tobacco manufactures, clothing, metal products, lumber and timber products, brick and tile, drugs, soaps, and chemicals.

Chief Cities.—St. Louis (775,000), Kansas City (325,000), St. Joseph (78,000), Springfield, Joplin, Jefferson City (capital).

MISSOURI. Missouri is one of the north central states of the Union, lying about halfway between the Atlantic Ocean and the Rocky Mountains, and between Canada and the Gulf of Mexico. It extends farther south than Virginia, yet is farther north than Kansas; and in the days of the Civil War this double connection with North and South was also noticeable. Missouri is especially favored in bordering upon the country's greatest river, the Mississippi, and being traversed for its entire width by the Mississippi's great tributary, the Missouri. With the many smaller streams that flow into them, Missouri has a navigable river system probably not surpassed in length by that of any other state. The Mississippi separates the state from Illinois, Kentucky, and Tennessee; and the Missouri, after forming part of the western boundary, turns east at Kansas City and flows through the heart of the state, joining the Mississippi about ten miles above St. Louis.

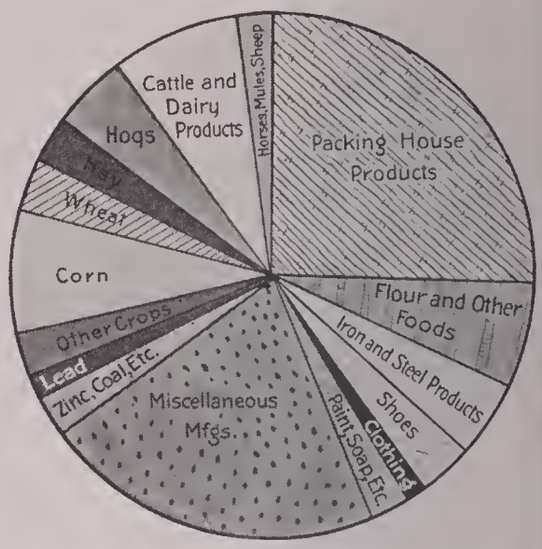
The landscape is widely varied. In the north and west are wide fertile prairies of rich alluvial soil, which merge on the west into the higher grassy pasture plains of Kansas. To the south the prairies give way to the rough densely forested slopes of the Ozark Mountains, which extend into southern Illinois, Oklahoma, and northern Arkansas.

The Ozark Mountains are really the erosive remnants of a former plateau, into which many valleys have been cut by streams. The crests in Missouri range up to about 1,800 feet above sea level. These hills afford some of the most beautiful scenery of the Mississippi basin. Between great rock cliffs are deep narrow valleys, where lie clear rapid streams and wonderful springs. There are a number of great caves, many miles long, like that described in 'Tom Sawyer', which contain hidden streams and great halls and galleries adorned with stalactites. There are also numerous groups of mineral springs, and these with the attractive scenery and healthful climate make some localities of the Ozark region popular health resorts. Among the well-known mineral watering places are Excelsior Springs near Kansas City, and Sweet Springs near Sedalia.

In the southeastern part of the state are many miles of fertile bottomlands, swampy in the lowest portions but for the most part well drained.

The climate varies between rather wide extremes, since the state lies in the center of the continent far from the oceans. While the Ozarks temper agreeably the summers in the southwest, they do not affect the climate of the state as a whole. The winters are generally mild, but the temperature sometimes falls

WHERE EAST MEETS WEST AND NORTH MEETS SOUTH



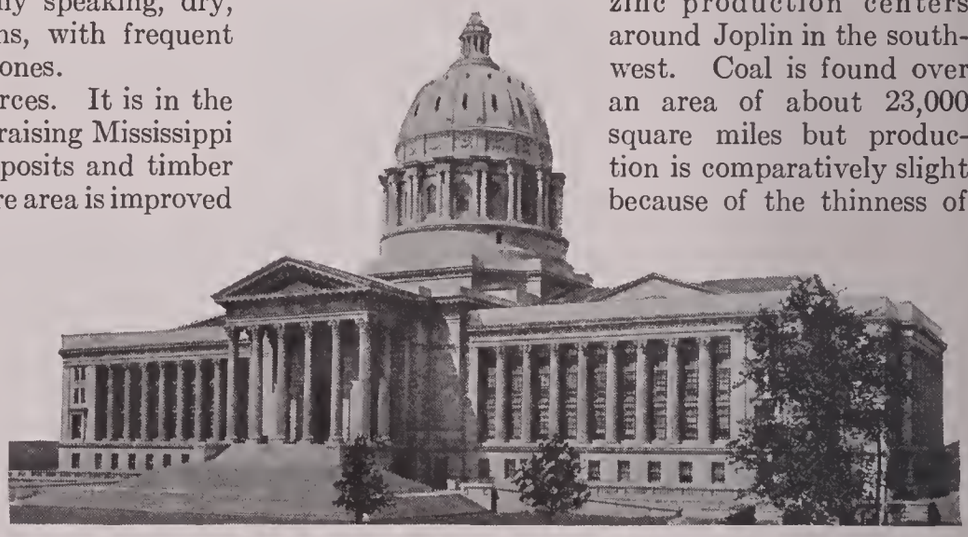
Missouri may be said to be the "cross-roads" state of the Union, lying midway between the Northern and Southern, the Eastern and Western States. Bordered by the Mississippi and crossed by the Missouri River, it is one of the best watered areas in the United States.

below zero and about once in every four or five years the Mississippi freezes partly as a result of floating ice from the north. The Missouri River is often covered with ice in the winter months. In the summers short periods of almost tropical heat are frequent. The climate is, generally speaking, dry, although there are abundant rains, with frequent thunder storms and occasional cyclones.

Missouri is rich in natural resources. It is in the heart of the agricultural and stock-raising Mississippi basin and has valuable mineral deposits and timber resources. More than half the entire area is improved land. Its rich soil places it among the leading ten states in the value of its diversified agricultural products. In corn it is usually in third or fourth place. Its other chief crops are wheat, hay, oats and other cereals, and potatoes. Apples and peaches grow in all parts of the state and many kinds of fruit can be cultivated successfully that cannot be grown farther north, such as apricots, tangerines, and varieties of grapes. In the southern part cotton, tobacco, and flax are raised. The raising of cattle and hogs is an important industry on the central plains, where clover and timothy flourish, and in the southern counties there are large sheep farms. No state with the exception of Texas raises so many mules, and Missouri mules and its fine blooded horses are known everywhere for their superior quality.

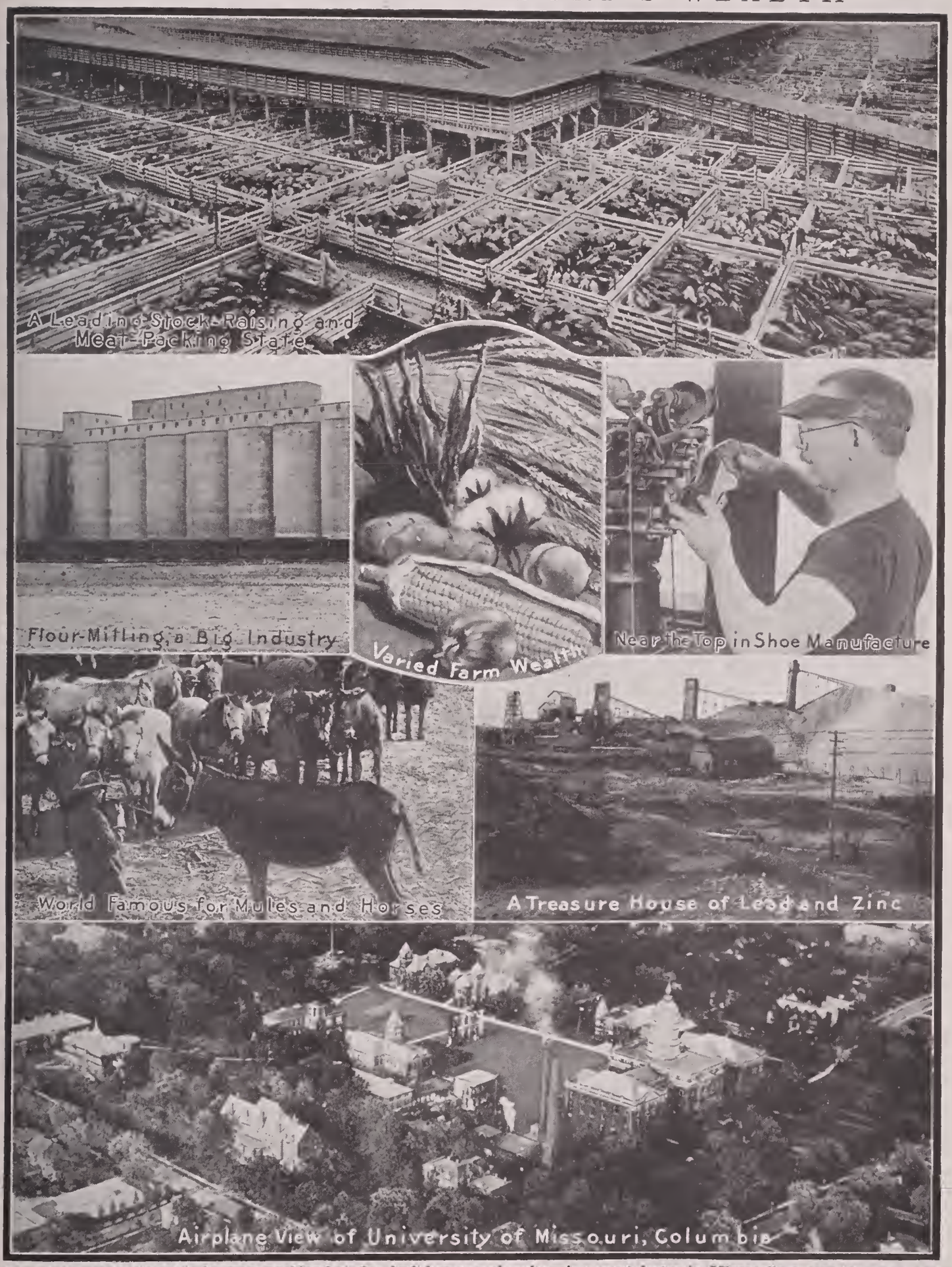
Most of the unimproved land is covered with forests of valuable timber, mostly hardwood, especially in the Ozark district. Missouri is one of the few central states that still market railroad ties, lumber, lath, and shingles in large quantities.

Missouri is one of the world's most important sources of supply for lead, and for a time it led all the states in the production of zinc. The chief lead district is in the southeastern part of the state, while zinc production centers around Joplin in the southwest. Coal is found over an area of about 23,000 square miles but production is comparatively slight because of the thinness of the seams. Iron ore is widely distributed in the Ozark region. Iron Mountain, about 80 miles south of St. Louis, is one of the largest known masses of iron ore in the world, but the output has long ceased to be significant. There are quarries of fine granite and limestone and extensive clay deposits suitable



The Missouri State Capitol shown here is situated on a bluff overlooking the Missouri River at Jefferson City.

GLIMPSES AT MISSOURI'S WEALTH



Live stock—not only cattle for meat packing but also draft horses and mules—is a great factor in Missouri's prosperity; corn and other crops also play prominent parts. Manufactures, including flour milling and the boot and shoe industry, contribute largely to the state's wealth. In the production of lead and zinc, Missouri is one of the world's important sources. The University of Missouri serves the state with many special departments, including a school of mines at Rolla.

contained in the Easy Reference Fact-Index at the end of this work

for pottery-making. Petroleum and natural gas occur in small quantities near the Kansas line.

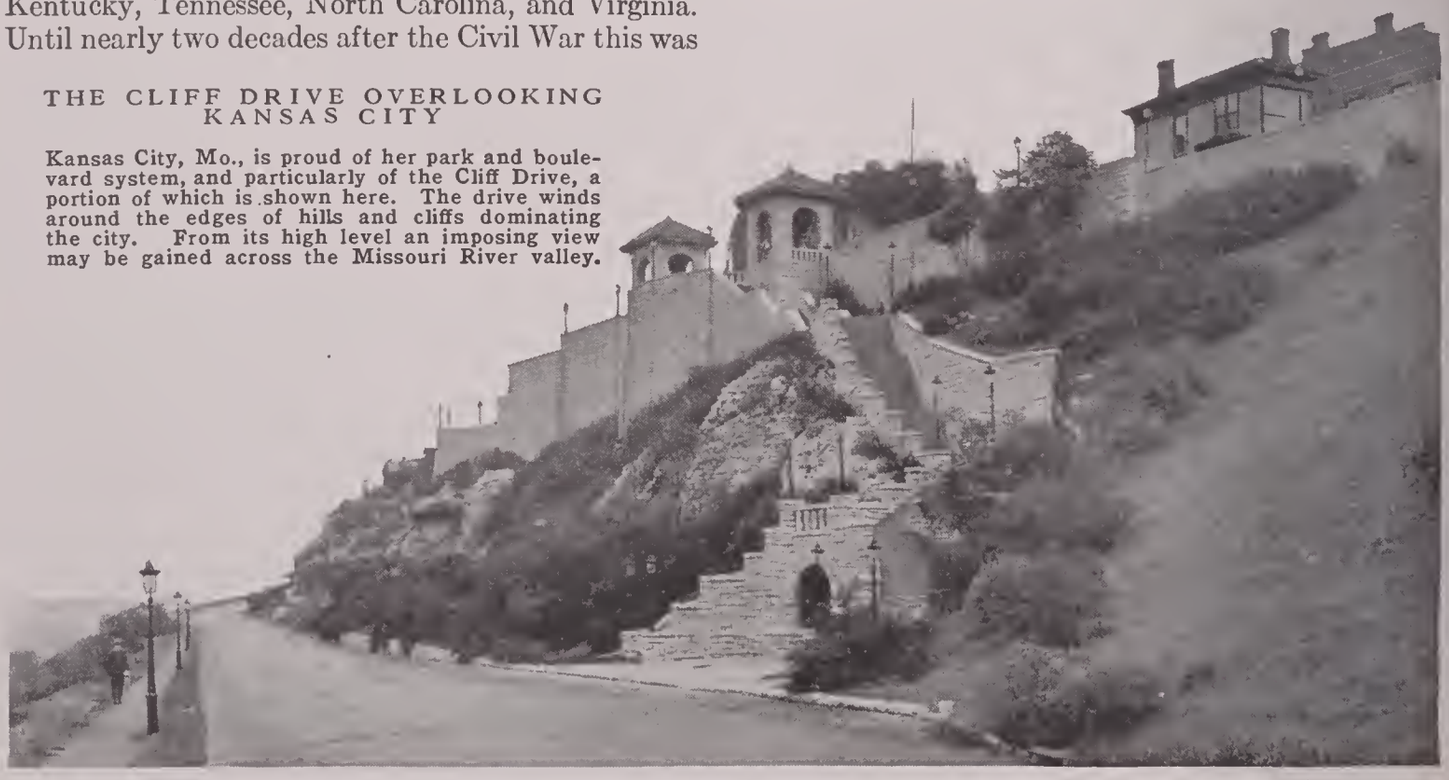
Missouri also takes high rank as a manufacturing state because of its abundance of raw materials and its central location with good transportation facilities by rail and water. St. Louis is the industrial center (*see* St. Louis), but Kansas City and St. Joseph are also important centers for various branches of trade (*see* Kansas City, Mo.). The leading industries are beef- and pork-packing (the largest stockyards being in Kansas City, South St. Joseph, and St. Louis), and the manufacture of boots and shoes, in which the state is only surpassed by Massachusetts and New York. Among the other varied products are portland cement, railroad and street-cars, clothing, flour and bakery products, lumber and timber products, tobacco products and corn-cob pipes, foundry and machine shop work, pearl buttons, glass, and pottery. The capital is Jefferson City (population, about 15,000), on the south bank of the Missouri in the center of the state; and the state university is at Columbia, some 30 miles north of the capital.

A network of railroads covers the northern and central part of the state, but there are a few counties in the southern tier without railroads. River transportation, neglected for many years after the Civil War, is being revived. Cereals, cotton, and other products are shipped from St. Louis to New Orleans by boat, and efforts have been made to develop the Missouri for navigation between St. Louis and Kansas City.

Four chief racial units have gone to the making of the population of Missouri. The earliest settlers were the French, whose descendants still form a conspicuous element in St. Louis and other river cities. The next important wave came from the southern states—Kentucky, Tennessee, North Carolina, and Virginia. Until nearly two decades after the Civil War this was one of the chief elements in the state, as was shown by the troubled history of the Civil War period. A great number of Germans entered the state from 1845 on, and the Irish also came in considerable numbers. Recent immigration has not been large, less than 10 per cent of the population being of foreign parentage. The Ozarks are populated almost exclusively by descendants of the mountaineers of Kentucky and Tennessee, who lived here in comparative isolation under primitive conditions until the exploitation of mineral resources began to open up this region.

The early French explorers were the first white men to visit this region, and it was included by La Salle in 1682, in the "Louisiana Territory" which he claimed for the king of France. St. Louis was settled in 1764. For many years there were no settlements except on the rivers. With the remaining territory west of the Mississippi River, this region was transferred by France to Spain in 1762. In 1800 it was ceded back to France, and the whole territory was purchased by the United States in 1803 (*see* Louisiana Purchase). The Territory of Missouri, including all that lay north of Arkansas, was organized in 1812. In that year a remarkable series of earthquakes about New Madrid, in the southeast, opened great fissures in the earth and formed big lakes from portions of the Mississippi River.

Bordering as it did on the slave states, Missouri Territory was a point of bitter contention in the slavery question. When it asked for admission to the Union, in 1818, the controversy became nation-wide (*see* Missouri Compromise). Upon admission as a state in 1821, the capital was first located at St. Charles near St. Louis, but after six years was moved to Jefferson City. At first the entire western boundary was the meridian line which still forms the boundary south of Kansas City; but in 1837 the



THE CLIFF DRIVE OVERLOOKING KANSAS CITY

Kansas City, Mo., is proud of her park and boulevard system, and particularly of the Cliff Drive, a portion of which is shown here. The drive winds around the edges of hills and cliffs dominating the city. From its high level an imposing view may be gained across the Missouri River valley.

"Platte Purchase," lying between that meridian and the Missouri River on the northwest, was added. In 1838 occurred what is called the "Mormon War," in which volunteers were called for by the governor to drive out of the state members of that newly arisen sect, under their prophet, Joseph Smith. For many years St. Louis, then Independence, and lastly Kansas City were the bustling outfitting points for settlers moving westward on the Santa Fe and Oregon trails. Before the Civil War progress was made, largely with state aid, in the building of the Missouri Pacific railway and other railroad construction in the state.

Benton Democrats and old-time Whigs formed a nucleus for a strong anti-slavery party in Missouri even before the war. "Every emigrant from the east or Europe, every mile of railroad constructed in the state, every mine opened, is the auxiliary of the party," said a St. Louis paper in 1857. A convention elected early in 1861 to "carry the state out of the Union" surprised its promoters by refusing flatly to do so. And when the governor sought to seize the arsenal at St. Louis and to impede the enlistment of Union forces, his policy was defeated by Captain Nathaniel Lyon and an energetic group of Missouri Unionists. Missouri was saved to the Union, but the people were about equally divided in sentiment and often members of the same family joined opposing sides. As a border state Missouri suffered severely during the war, but has since been very prosperous.

MISSOURI COMPROMISE. At the beginning of 1818 the United States was in the midst of the period of political stagnation known as "the Era of Good Feeling." Suddenly Missouri asked to be admitted to the Union as a state, and the "good feeling" gave way to a bitter quarrel.

There were then in the Union twelve slave states and twelve free states, and since the North was gaining in population more rapidly than the South, the latter was anxious to keep the balance in the Senate even. The North, on the other hand, wished to extend into the territory west of the Mississippi the boundary between slavery and free soil which already ran along Mason and Dixon's line, and down the Ohio River. Since most of Missouri lies north of the mouth of the Ohio, the North refused to let Missouri come in as a slave state. When Maine asked to be admitted the next year as a free state, the South retaliated by opposing it. After long arguments both sides agreed in 1820 to what is called the Missouri Compromise. Maine was to come in as a free state, and Missouri as a slave state, but all states which should thereafter be made out of the Louisiana Purchase north of latitude 36° 30′ (the southern boundary of Missouri) should be free states. A second controversy arose when Missouri presented itself with a constitution prohibiting the entrance into the state of free negroes, and it was not until 1821 that this provision was stricken out and Missouri became a state. The provisions of the compromise were repealed by the Kansas-Nebraska bill in 1854.

MISSOURI RIVER. Had the Missouri River been discovered before the Mississippi there is but little doubt that the same name would have been applied to both streams, and the upper Mississippi—which is less than half the Missouri's length—would have been considered merely a tributary of what is really the longest river in the world. From its source among the Rocky Mountains in southwestern Montana, to its conflux with the Mississippi just above St. Louis, the Missouri winds through a distance of 2,456 miles; while to the Gulf of Mexico the Missouri-Mississippi is 4,220 miles long.

Rising in the confluence of the Jefferson, Madison, and Gallatin rivers, the Missouri, or "Big Muddy"—an ugly tortuous stream—dashes almost due north through a beautiful mountainous region. Sixteen miles east of Helena, Montana, it flows through a narrow canyon or gorge, with walls 1,200 feet high, called the Gates of the Rocky Mountains, where the beauty and grandeur of the scenery is almost unequaled. Farther along, about 350 miles from its source, are the Great Falls of the Missouri, where the river descends nearly 400 feet in 16 miles, by a series of four cataracts the highest of which has a fall of 90 feet. Turning westward and then southwest, the Missouri flows through North Dakota and South Dakota, forms part of the boundary between the latter state and Nebraska, then forms the boundary between Nebraska and Iowa, Nebraska and Missouri, and Kansas and Missouri as far as Kansas City. At that point it enters the state of Missouri and flows eastward until it reaches the Mississippi.

The Missouri is a rapid stream, noted for the irregularity of its course and for the huge deposits of silt it carries with it. It rushes along furiously, breaking down its banks and sweeping into its current portions of land, branches, and uprooted trees. In the lower part of its course it moves more slowly, as it crosses some of the most fertile plains in the United States. With its tributaries it drains an area of over 500,000 square miles. In Montana it receives its largest tributary, the Yellowstone River. In South Dakota the Cheyenne, in Nebraska the Platte, and in Missouri the Kansas are the chief tributaries.

The Limits of Navigation

During high water steamboats can ascend the river to Fort Benton, about 2,300 miles from the mouth. During low water, in the summer and autumn, Fort Buford at the mouth of Yellowstone River is the head of navigation. Owing to the dangers of navigation and the general neglect of river transportation, the commerce of the Missouri is not so extensive as formerly, though since 1908 the people of the large river ports have been putting forth every effort to increase its traffic by building levees and removing the snags with which it is choked.

Marquette and Joliet were the first explorers to discover the mouth of the Missouri, as they came down the Mississippi in 1673. It was not until the next century, however, that fur traders made their

way through its turbid waters in canoes and primitive boats. In 1804–05, Captain Meriwether Lewis and William Clark, under orders from President Jefferson to explore the land west of the Mississippi, traveled the full length of the river, ascending it to its source and giving the first accurate accounts of its course. (*See* Lewis and Clark Expedition.) In 1819 the first steamboat was seen on the river, and in the middle of that century gold seekers bound for California found it their last link with civilization as they steamed up its waters to St. Joseph.

MISTLETOE. Do you know that this familiar Christmas decoration, with its waxen white berries and glossy evergreen leaves, never takes root in the ground, but is a parasite that grows from a "sucker root" on the trunks of other trees? It belongs to a genus of which there are about 20 species, all parasitic, distributed through the warmer parts of the Old World. Of these only the mistletoe proper (*Viscum album*) is a native of Europe. The American mistletoe (*Phoradendron flavescens*) grows from New Jersey southward and westward, and closely resembles the European in general appearance.

The mistletoe appears as a bushy growth with many forking branches, often four feet long. It has oval leaves and tiny yellow blossoms, followed by the little white berries that ripen after snow flies. It grows on both deciduous and evergreen trees. The poplar, willow, mountain ash, and maple are among its favorites. In England it grows in greatest abundance on the apple tree. It is rarely found on the oak. The birds eat the pulpy berries. Flying from tree to tree, they carry the seeds, which lodge in the bark and grow.

Because of its peculiar character the mistletoe played a prominent part in German and Norse mythology and it was with an arrow from its wood that the beautiful god Balder was slain (*see* Balder). The mistletoe was said to bring happiness, safety, and good fortune so long as it did not touch the ground. Perhaps this is the reason why today we always hang up our mistletoe in the window, or on the chandelier. The Celts held the plant in veneration, especially when found on the oak.

MOBILE, ALA. The second city of Alabama and its only seaport, "the City of Five Flags"—as Mobile is called—has had a long romantic history. It was founded in 1702 by the French at a point north of the present city, and was the capital of the French province of Louisiana until 1720. In 1763 it was ceded to the English, but in 1780 the Spanish captured it. In 1813, under the claim that Mobile was part of the Louisiana Territory sold by France to the United States in 1803, it was seized for the United States by Gen. James Wilkinson. During the Civil War it floated the Confederate flag almost to the end, for although Admiral Farragut captured the Confederate fleet and took the forts which guarded the entrance of Mobile Bay in August 1864, Mobile was not taken until April 1865.

Mobile today is a city of parks and of broad streets, many of them shaded with live oaks and magnolias and lined with beautiful white colonial residences. Many historic landmarks remain, including the cathedral of the Immaculate Conception, a fine structure in Gothic style built by the French in 1720. The city occupies a sandy plain which rises gradually from a low water front along the Mobile River to a range of hills a few miles to the west. The channel to the Gulf (about 30 miles distant) has been widened and deepened to allow large ships to ascend to the wharves of the city. In the World War Mobile became an important ship-building and ship-repair port.

Several railway lines serve Mobile and a regular steamship traffic is carried on with ports in Europe, Cuba, Mexico, and Central and South America. Foreign commerce consists largely of the exportation of iron and steel products, cotton, lumber, and general cargoes from the Middle West, and importation of tropical fruits, especially bananas. Vegetables and citrus fruits are grown extensively in the vicinity, and the city has an important domestic trade in market garden produce, fish, and oysters. Population, over 60,000.

MOCCASIN SNAKE. Along the banks of streams or on the edges of swamps throughout the southern United States may be found the water moccasin, one of America's most poisonous snakes. Mostly it lies upon some old log or overhanging branch watching the water, and if some unfortunate fish or frog passes beneath its sentinel post, the moccasin drops upon it like a flash. If the victim escapes the first rush, the snake will pursue it with superior swiftness far beneath the surface, returning to land to swallow its meal.

The moccasin's body is thick and heavy, with a quickly tapering tail. In color, it is dark brown with obscure black marks on its sides and yellowish spots on throat and abdomen. While it will flee rapidly at the approach of man, if cornered it will fight savagely, striking out with wide open jaws and displaying the white gullet, which has given it the nickname "cotton-mouth." It is chiefly dangerous when it invades the flooded rice fields.

With the copperhead and the rattlesnake, the moccasin belongs to the "pit-viper" family of snakes (*see* Copperhead; Rattlesnake; Viper). Its young are born alive, usually eight to ten in number. Scientific name, *Ancistrodon piscivorus*.

MOCKING-BIRD. You *have* to "listen to the mocking-bird" if you visit the Gulf States between the months of February and August, for during that season he sings both day and night. What the nightingale is to Europe, the mocker is to the Southern states. On moonlight nights one singer will begin his serenade, soon others will join, until the lovely chorus has awakened the little day birds of field and orchard who lift their heads to listen, and, before again tucking them under their wings, add their own particular little song to the concert.

Besides his natural song, the mocking-bird imitates the notes of many other birds. This power he acquires by practice and he is a most exacting self-teacher—going over his lesson again and again, until he is able to deceive even an attentive listener. He thus imitates the cry of the night-hawk and even the barking of a dog and other unmusical sounds.

Mocking-birds have many endearing traits. They are most courageous and, in defense of their young, will attack dogs, cats, or even man. If kindly treated they become very trustful and will build in shrubbery about the very doorway of a house, perching sociably upon the window ledge or even venturing inside. The nest is generally within 10 feet of the ground and is made of grass, sticks, or any convenient material. The four greenish-blue eggs are spotted with brown.

The bird itself, which belongs to the family of "mimic thrushes" (*Mimidae*), is about 10 inches long. The upper feathers are brownish-gray, and the under feathers lighter. The wings and tail are long and rounded (*see* Birds for illustration in colors). It breeds throughout the United States, north to Iowa. Scientific name, *Mimus polyglottus*. The mocking-bird found in the southwestern states and northern Mexico is larger than the Southern mocker, while the mountain mocking-bird is smaller.

The MOHAMMEDAN RELIGION *and Its* FOUNDER

Every good Mohammedan prays five times a day, with his face turned toward the sacred city of Mecca. Here we see a group of devout white-clad Arabs gathered on the edge of the desert at Biskra in Algeria. Their feet bare, they are in the first attitude of prayer, reciting: "There is no God but Allah, and Mohammed is his Prophet."

MOHAMMED (567–632) AND MOHAMMEDANISM. Few romances are stranger than the career of this founder of one of the world's great historic religions. Born in Mecca of a good Arabian family, Mohammed (or Mahammed, also written Mahomet) was early left an orphan and was brought up by a poor but kind uncle. For a time he was a camel driver and accompanied caravans from Mecca to surrounding countries with which the Arabs had trade. And as he grew older he thought seriously upon all that he saw and heard, in the desert and in the cities, as he plied to and fro in the course of his calling.

The matter that caused deepest concern to the thoughtful young man was the ignorance and superstition of the Meccans and other Arabs, who were idolators. Marrying a rich widow named Khadija, he himself became a merchant, but he continued to brood on the low moral condition of his people. At this time the Jewish religion and Christianity flourished in some communities of southern Arabia, and Mohammed could not help contrasting these clean religions with the idolatry of the Arabs. Mohammed became interested in the Bible and the books of the Jews, and grew familiar with the teachings and lives of Jesus Christ and the Prophets. He became convinced that there was but one true God, and not a mere multitude of magic-working spirits (like the *genii* of Aladdin's lamp) who dwelt in sticks and stones and graven images. So he began ridiculing the worship of the Meccans and preaching a new religion. He even claimed that the archangel Gabriel had appeared to him, revealing the true faith and commanding him to spread it abroad.

Mohammed soon gained the support of his own family and clan. From others came persecution so bitter that he was forced to flee from Mecca to the neighboring city of Medina. Many of his followers took refuge for a time with the Christian Abyssinians,

who dwelt on the African shores of the Red Sea. This flight or "hegira" of Mohammed (622 A.D.) is the date from which the whole Mohammedan world reckons time, as we do from the birth of Christ. It was also the turning point in Mohammed's career. He had proclaimed himself as the true interpreter of God, as a prophet, and fiercely denounced all idolators. At Medina the Jews were powerful, and, still having an admiration for their religion, Mohammed thought that he could combine with them in furthering his new worship. But the Jews refused his advances.

After winning a powerful position in Medina, Mohammed declared war against both the Jews and the Meccans. When the Arabs began to flock to his standard he proclaimed a savage crusade, which continued long after his death. Soon all Arabia was at his feet, for the desert Arabs rejoiced at the opportunity to plunder the rich Meccan caravans. Mohammed fiercely suppressed idolatry, and allowed no one to reside in his city of Medina unless he acknowledged the new faith. He boldly sent letters to all the known kings of Europe and Asia, calling upon them to acknowledge that "there is no God but Allah, and Mohammed is his Prophet." He died at Medina in 632, ten years after his flight. His tomb in Medina, as well as the sacred city of Mecca, are places of pilgrimage for all good Mohammedans. From poverty to rich empire, from obscurity to fanatical reverence as the Prophet and founder of a great new religion, is the romantic history of this camel boy of the Arabian desert.

Within a hundred years after Mohammed's death, not merely Arabia, but Syria, Persia, Egypt, northern Africa, and Spain had been conquered by Mohammed's victorious successors (called "califs"). His religion was prepared for yet further extension into Asia Minor, eastern Europe, central and eastern Asia, and the interior of Africa. The spread of Roman conquest about the Mediterranean had taken more than four times as long. The progress of the Christian religion in its first century was hidden among the humble, and restricted to a much narrower area.

WHERE THE CALL TO PRAYER RINGS OUT

Three times a day from those high slender minarets of this Constantinople mosque tnere sounds out above the rattle of street cars and the chugging of automobiles the old Mohammedan call to prayer. The caller or Muezzin mounts in the morning to the first balcony, at noon to the second balcony, and at sunset to the uppermost balcony. No calls are issued for the afternoon and night prayers.

Today Mohammedanism (sometimes called "Islam") is the faith of about 225,000,000 people in Asia, Africa, and eastern Europe. It ranks third in numbers among the great religions, only Christianity and the religion of the Chinese Confucius having more followers. Its sacred book is the Koran (*see* Koran), made up of discourses and sayings of the Prophet. Mohammed himself was illiterate, but his sayings were written down by his followers in Arabic, the sacred language studied by all Moslems (followers of Mohammed), who aim to know the Koran by heart. He borrowed largely from Christianity and Judaism, and Christ, Adam, Moses, and the angel Gabriel are mentioned with great reverence. Mohammedanism forbids the use of strong drink, or the lending of money at interest. Every Moslem must pray five times a day, facing toward Mecca. The *muezzins* or criers give the weird "call to prayer" from the tall minarets of the mosques or Mohammedan temples. One month in the year, called "Ramadan," is kept as a season of fasting, when Moslems may not eat between dawn and sunset. The use of pork, as among the Jews and Hindus, is strictly forbidden. Mohammed himself married many wives in accordance with the oriental custom, his favorite wife being Ayesha. He adopted polygamy in his religion, but limited the number of wives for his followers to four. The greatest blot on this religion is that women are not regarded as having souls or as sharing in any way in that Paradise which is promised after death to the faithful followers of the Prophet. Divorce and inheritance rules also favor men unduly.

MOHAMMED'S TRIUMPHANT RETURN TO MECCA

When his persecutors forced him to flee from Mecca, the city of his birth, Mohammed went to Medina, and there aroused fierce enthusiasm for the faith he preached. The Arabs flocked to his standard, and with their aid he soon overwhelmed the rich Meccans. returning as a conqueror to the city which he had left a hunted fugitive.

contained in the Easy Reference Fact-Index at the end of this work

The Mohammedan religion is still spreading in Asia, and particularly in Africa, where its democratic teachings appeal to the negroes. It is a fact that no Moslem draws a color line against other Moslems, whether black, yellow, or brown. The present calif, or head of Mohammedanism, is the Sultan of Turkey. The califate began with Abu Bekr, father of Ayesha and Mohammed's faithful follower, and has been handed down from one family to another, thus causing a great deal of trouble between the Moslems of the world. Like Christianity, Mohammedanism is divided by sects which differ in their interpretation of the teachings of the founder. Chief of these are the Sunnites, or orthodox Mohammedans, and the Shiites or "intellectuals." The latter insist the descendants of Ali, husband of the Prophet's daughter Fatima, are the only legitimate califs. Persia is today the stronghold of the Shiites. But all Moslems in common make pilgrimages to Mecca and Medina. The United States has more than 50,000 Moslems in the Philippine Islands.

Halting the Wave of Conquest

The "Saracens," as followers of Islam were called in the Middle Ages, passed from Africa into Spain in 711. At the famous battle of Tours in 732, exactly 100 years after Mohammed's death, the Mohammedan invasion of France was halted by Charles Martel, grandfather of Charlemagne. Driven back into Spain on the west, and held in check by the Byzantine Empire at Constantinople, the Arabs, Moors, and other Mohammedan peoples settled down in their new-won lands and developed from the 8th to the 12th centuries a culture which far surpassed that of western Europe.

The centers of this culture were Damascus, in Syria; Bagdad, on the river Tigris; Cairo, on the lower Nile; and Cordova, in Spain. Here were gathered together the threads of civilization drawn from Greece, Persia, Syria, Egypt, India, and Spain. Agriculture made great strides. Irrigation was practiced extensively and tree-grafting became a science. Among new plants introduced into Europe from the Arabs—especially during the crusades—were rice, sugar cane, hemp, artichokes, asparagus, the mulberry, orange, lemon, and apricot.

In manufactures the Saracens excelled. The sword blades of Toledo and Damascus were world renowned. Equal skill was shown in the fashioning of vases, lamps, and like articles of copper, bronze, and silver; in the weaving of carpets and rugs which are still unsurpassed; in the molding of fine glass and pottery. Sweetmeats, syrups, essences, and perfumes were produced. Paper, without which the invention of printing would have been valueless, came to Europe through the Mohammedans. The finest leather goods came from Cordova and Morocco.

Arab caravans threaded their way into central Africa, and across the wilds of Asia to China and India to fetch the riches of these far-off lands, and Arab ships distributed them in the Mediterranean.

In literature, particularly poetry, and in science the Mohammedans attained a high degree of development. The University of Cairo at one time had 12,000 students. In Spain in the 10th century a library of 400,000 manuscripts is said to have been collected. Learned Arabs did much to preserve and spread broadcast the writings of the great Greek philosopher Aristotle, after he had been all but forgotten in western Europe. In mathematics Mohammedan scholars led the world. Algebra was practically their creation, though its elements were derived from the Greeks and the Hindus. The so-called "Arabic" numerals were introduced by them and replaced the clumsy Roman numerals. In astronomy they made notable advances. In chemistry many of our common terms, such as "elixir," "alcohol," "alkali," which are of Arabic origin, prove our indebtedness to these early students. In medicine their skill was in advance of European physicians, and they virtually laid the foundation of scientific pharmacy, many of their preparations being still in use. The richness and grace of their architecture is evident in all their lands, especially in Moorish Spain. Byzantine civilization alone was the equal of that so widely spread in the Mohammedan world.

All of this culture began to wane, however, when the Moslem world was split by the rise of the Turkish power in the 11th century. Great as was their early knowledge, the religion of the Moslems made the great mass of the people intolerant and unprogressive. Today the golden era of Mohammedan art and learning is but a memory.

MOLE. Destined to spend his whole life in darkness, digging, digging, digging, in order to build his home and to obtain the food necessary for his existence, a queer little creature, scarcely able to see or hear, and yet marvelously adapted for the part Nature has designed him to play in the world—the common mole is one of the most interesting of all animals.

You can always find the mole by the long ridge of cracked earth that zigzags across fields—the roof of his tunnel. It is lively work to dig him out, for he may be at either end, anywhere along the route, or in a side chamber. In your hand he lies helpless, a flat ball of fine, velvety, mouse-colored fur, about six inches long, with a naked, pink tail about an inch long. He has no neck; his ears are only little openings concealed in the fur; his dim eyes are tiny points covered with skin. If you put the sprawly wriggly creature on the ground, he scrambles about frantically until he finds a soft spot. Then he begins to dig with his strong spadelike fore feet and in less than one minute the animal has disappeared into a burrow in the ground. The swiftness with which a mole works is almost incredible; in a single night one has been known to tunnel more than 75 yards.

Moles are found both in the Old and the New World in the Northern Hemisphere. The common mole disfigures lawns, pastures, and gardens extensively by the ridges and furrows it makes hunting

after food, but as it feeds on injurious larvae and insects, it compensates for the damage. They are among the most voracious of all animals, also eating earthworms in quantities, and occasionally field mice.

The mole ordinarily lives in a colony, in a complicated fortress. In little hillocks of earth, called molehills, there is constructed a central chamber surrounded by two ringlike galleries, one above the other. These circular galleries are connected by vertical passages, and the upper one has five openings into the central cavity. From the lower gallery about nine alleys lead off in different directions toward the feeding-grounds.

LITTLE MR. MOLE'S CASTLE UNDER THE GROUND

We are not to understand, of course, that a mole's underground fortress is so precisely laid out as this but its character and arrangement is substantially as shown—a circular chamber surrounded by galleries with openings into the circular cavity and tunnels leading away in different directions. From this central "fortress" the mole sallies forth in search of food, pushing his way through the soil with amazing rapidity. In a single night a mole has been known to tunnel nearly 100 yards, eating as he went.

The American species are all small, and have very soft silky fur, as have also their European cousins. The common mole ranges from southern Canada and the lowlands of the eastern United States southward to Florida.

The only other North American member of the *Insectivora*, or insect-eating order of animals to which the mole belongs is the shrew, a mouselike creature, with a long pointed snout. Unlike the mole, however, the shrew has well-developed eyes and ears, and its feet are formed for running and not for burrowing. The best-known species in North America are the short-tailed shrew or mole-shrew, a ravenous little animal, about four and a half inches long, with a tail measuring an inch; and the long-tailed shrew. The pigmy shrew is the smallest American mammal, its body being little more than an inch long.

Scientific name of common American mole, *Scalops aquaticus*. American short-tailed shrew, *Blarina brevicauda;* long-tailed shrew, *Sorex personatus*.

Molière (*mō-lyâr'*) (Jean-Baptiste Poquelin) (1622–1673). What Shakespeare was to English literature, that the great comic dramatist Molière was to France. He is not so broad and deep as Shakespeare in his view of human life, nor so full of poetry and fancy; but no dramatist of modern times has equaled him in the comedy of manners—that form of comedy in which one laughs at the fashions and foibles of his time. And Molière, though he portrays his own countrymen and his own age, belongs like Shakespeare to all lands and all ages; and now after nearly three centuries his plays still continue to delight great audiences, as they did in the days of his patron, "the Grand Monarch" Louis XIV.

Jean Baptiste Poquelin—for that was his real name, and "Molière" only an assumed one—was born in Paris, the son of a prosperous furniture-maker who held the office of upholsterer to the king. Instead of following his father's calling, or taking up the practice of law, for which he had been educated, the young man chose the uncertain life of a strolling player, and it was at that time that he took the stage name Molière. As an actor and theatrical manager, he learned the art of the stage, and gained that perfect mastery of dramatic structure for which his plays are noted. He also learned to know human nature and especially did he search out the weaknesses, the follies, the vanities and pretensions, the ludicrous traits in men and women. He usually emphasizes one outstanding characteristic. Harpagon in 'L'Avare' (The Miser) and the hypocrite 'Tartuffe' are immortal creations of his genius; and few characters have aroused the world's laughter as Monsieur Jourdain in 'Le Bourgeois gentilhomme'.

Molière's last play was 'Le Malade imaginaire' (The Imaginary Invalid), and in this he himself played the leading part, that of Argan. Though the character was suffering only from an imaginary disease, the actor himself was really very ill. In the midst of the play he fell into a violent fit of coughing, and died a half hour after the performance. It was Molière's last jest.

Molière's chief works are: 'Les précieuses ridicules' (The Affected Ladies), 1659; 'L'École des maris' (The School for Husbands), 1661; 'L'École des femmes' (The School for Wives), 1662; 'Le Mariage forcé' (The Forced Marriage), 1664; 'Tartuffe', 1664; 'Don Juan', 1665; 'L'Amour médecin' (Love as a Physician), 1665; 'Le Misanthrope' (The Misan-

thrope), 1666; 'Le Médecin malgré lui' (The Physician in Spite of Himself), 1666; 'L'Avare' (The Miser), 1668; 'Le Bourgeois gentilhomme' (The Tradesman Turned Gentleman), 1670; 'Les Fourberies de Scapin' (The Rogueries of Scapin), 1671; 'Les Femmes savantes' (The Learned Ladies), 1672; 'Le Malade imaginaire' (The Imaginary Invalid), 1673.

MOLLUSKS. The large group of animals called mollusks, or *mollusca*, have soft bodies which are never divided into rings or segments, as are the bodies of *crustacea* (crabs, lobsters, crawfishes, etc.) and some worms. Many forms of mollusks are provided with hard, limy, or "chitinous" shells, which are either carried on the outside or are partially or wholly enclosed by a sheet of shell-forming muscular tissue, called the "mantle." They live on land and in water, both fresh and salt. There are four principal groups or classes.

(1) *Cephalopods.*—The most highly organized of all mollusks are the Cephalopods, or "head-footed" mollusks, which are so called from the fact that the head is surrounded by a circle of eight or ten sucker-bearing tentacles. In some ways the cephalopods approach in intelligence and in complexity of structure the vertebrates, or animals with a backbone. They have often been the subject of poem and story, and the beauty of coloring in some forms is so striking as to merit the attention of the artist as well.

Cephalopods include the nautilus, the argonaut, the octopus, the cuttlefish, and the squid. The nautilus is the only member of the group now living which carries an external skeleton, or shell. But long before human history began—millions and millions of years ago—there were many shelled cephalopods in the sea, all of which except the nautilus became extinct. From their remains in the earth we know that these did not attain the size of the cephalopods now living, and since the nautilus with its shell has a brain less highly developed, and is less intelligent, than the cephalopods without a shell, we infer that the shell limits both bodily and mental growth. We conclude that the squid could not have become a giant of the seas if it had been confined within a shell, however beautiful this might be.

Advantage of Doing without a Skeleton!

All cephalopods which have survived and become large possess either a small internal skeleton, or no skeleton at all. In the squids the shell is embedded in the "mantle," and has become reduced to a flexible remnant called the "pen," from its resemblance to the feathered quill pens used in former times. The cuttlefish has a calcareous, or limelike, skeleton, which supplies the cuttlebone which we feed to our canaries. The shell of the beautiful *paper* nautilus, or argonaut, is not a skeleton shell at all, but a mere case used by the female for the protection of her eggs.

In all cephalopods the body is enveloped in a soft mantle. All possess a distinct head, and the circle of eight or ten sucker-bearing arms or tentacles which gives them their name. The tentacles correspond to the fore part of the "foot" in other mollusks. The mouth is in the middle of the disk formed by the tentacles. The large unwinking eyes, resembling those of a fish, are placed one on either side of the head. Through a siphon, formed from the hind part of the "foot," water is sucked in and expelled. In this way the creature breathes, as does a fish, while the rapid expulsion of the water is the chief means of locomotion.

The shape of the body varies in the different forms. It is globelike in some, and conical, egg-shaped, or cylindrical in others. The brain is inclosed, in most forms, by a cranial cartilage which also incloses the organs of hearing and supports the eyes.

Most, but not all, cephalopods possess an ink-sac or gland which secretes a dark fluid called "sepia," which can be discharged through the siphon at will. This beclouds the water, under cover of which the creature may escape from its enemies. Cephalopods also have the ability to change their color instantly by means of cells in their skin containing pigments. They are thus enabled to assume the appearance of their surroundings, which aids them both in eluding their enemies and in approaching their prey.

The Oyster and His Hatchet-Footed Relations

(2) *Bivalves.*—This second group of mollusks is given its name because the shell is in two pieces. The animals in this group have a "foot" shaped like a stone ax, which serves as a burrowing organ, and from this they are sometimes called *Pelecypods* or "hatchet-footed" mollusks. This group includes the oyster, the clam, the mussel, and the scallop. In these animals the head is rudimentary in the adult, but present in the young. The organs are symmetrically placed in the body, which is inclosed by the two lobes of the "mantle" and in turn is covered by the two half-shells or "valves." They breathe by means of gills which lie under the mantle, one on either side.

The bivalves are a very important group of mollusks because they supply man with a large amount of food. Oysters, clams, and mussels are collected in enormous quantities in many parts of the world and used as a substitute for meat. The shells of fresh-water mussels are manufactured into buttons. Pearls of fine quality have also been found in many kinds of mussels in all parts of the Mississippi valley, as well as in the oysters of the sea. Mussels are also of service as scavengers for they devour decaying organic substances in the lakes and streams which otherwise would pollute the water.

The "Stomach-Footed" Mollusks

(3) *Gastropods.*— These "stomach-footed" mollusks, which form the third group, are typified by the snail and the whelk. They have a distinct head which bears one or two pairs of sense organs—the tentacles, or "horns." The two eyes are placed on the tentacles. When there are two pairs of tentacles, the eyes are placed on the hinder pair. The "foot" forms a creeping disk, on top of which is a twisted hump, covered by the "mantle," and containing the digestive organs.

The animal usually is entirely covered by a shell that is attached to its body by a powerful muscle, which enables it to leave the shell and draw itself in

again at will. The form of the shell is determined by the hump. If this is twisted or coiled, the shell also is twisted. In some forms, as in the limpet, the shell is a simple cone. Many of the gastropods, like the periwinkle, close the mouth of the shell on retiring into it, with a trap-door. When the animal is extended full length, the trap-door lies on its back. Nearly all young gastropods have a trap-door before hatching from the eggs, but some discard it after they are hatched. In many forms, especially in land snails, enemies are kept out of the shell by numerous sharp teeth placed around the opening. The gastropods are found throughout the world, and furnish more than half of the 28,000 known species of living mollusks.

(4) *Amphineura.*—A fourth group, called *Amphineura* because of the doubling of their nerve-cords, contains the chitons, which are mollusks with a "coat-of-mail" shell—that is, with a small shell formed only on the upper surface. In these species the body is usually oval, and there is no distinct head. The feet constitute the entire lower part of the body. (*See also* Clams and Mussels; Cuttlefish, Squid, and Octopus; Nautilus; Oysters; Scallop; Shell; Snails and Slugs.)

MONEY: WHAT IT DOES *and* HOW IT IS MADE

How This Great Invention Helps Out in the Business of Life—How Clam Shells Were "Coined" by the Indians—The Difference between Paper and Metal Money—The History of Coinage—What is Meant by "Debasing" Coin

MONEY. In the early days people did not worry about money. They had no money. This does not mean that they had no wealth, for wealth is anything that requires labor to produce and which can be appropriated and exchanged. Money is simply a measure for wealth and a medium of exchange. These primitive people did not need money because each family produced nearly all of the things that were needed to feed, clothe, and shelter it. If a family had more of one thing than it needed, perhaps some other family had more of some other thing, and an exchange could be made that would satisfy both families.

Exchanging goods for goods in this way is "barter"; and the economists speak of such a situation as a state of "barter economy." Bartering was a very unsatisfactory way of doing business. Suppose for example that a shoemaker wished to trade part of the shoes he had for beef and flour and other things that he needed. He must find someone who happened to have the things that the shoemaker wanted and who also happened to want shoes. When this man was found it was then necessary to strike a bargain, which was difficult because there was no common measure of the value of shoes and beef and flour, and the other things that people need and use. In order to make it easier to exchange goods, people were led to establish some particular form of wealth to serve as a medium of exchange and as a common measure of value for all other forms of wealth—in other words, they invented "money."

Many different things have been used to serve as money as civilization has developed. Skins have been a medium of exchange in many hunting communities. In the southern colonies of America tobacco was used as money for a long time. The Assembly of Virginia passed a law declaring that tobacco could be used to pay taxes and that people must be willing to accept it in payment of debts—that is, it was made "legal tender." The early Romans and other early peoples all over the world measured their wealth in oxen or cattle. The Latin word *pecus* (meaning "oxen") is the root of the word *pecunia* (Latin for "money"). White and purple wampum beads, made of whelk and clam shells, were the money of the North American Indians, as cowry shells were of the natives of Africa and Hindustan; and for a similar reason, because of their value as ornaments. Salt, rice, tea, dates, ivory, and numberless other articles have been used as money at different times.

Sooner or later all communities came to use metals as money. Iron was used as money by the ancient Spartans; but because it is so heavy in proportion to its value, its place was taken by gold and silver. These metals are more satisfactory for money because they are precious, durable, and easily stamped.

At first gold and silver passed by weight, as gold dust often does in mining communities. Several of the common units of money were originally names of weights—as the Hebrew "shekel," the Anglo-Saxon "mark," the later English "pound," the older French "livre," and the Italian "lira," and so on. The earliest known coins are those of the Lydians in Asia Minor, dating from the 7th century B.C. Even after coining began, the coins were often not taken by count but by weight, because dishonest people clipped or filed the coins for the sake of the little particles of gold and silver thus gained. It is to prevent this that modern gold and silver coins are made with raised and "milled" edges, which show plainly any clipping or filing.

In all money systems today the government establishes a certain amount of metal as a standard unit of value. In the United States, 25.8 grains of gold 925/1000 pure is defined by law to be one dollar. This establishes what is called the "single gold standard." Some nations have attempted to use both gold and silver as a standard—known as a "double standard" or "bimetallism." When the double standard is used, the law fixes the ratio which the two metals shall bear to each other in the coinage. The famous slogan "16 to 1" in the political campaign of 1896 represented a demand for the unrestricted coinage of

silver dollars at the ratio by weight with the gold dollar of 16 to 1. Double standards have always failed because sooner or later the ratio between the real values of the two metals changes. When that happens one of the metals is said to be overrated or at a premium, while the other is underrated or at a discount. Consequently people tend to hoard or melt up the overrated metal, and use the cheaper metal to pay their debts. The cheaper money thus becomes the only money in circulation. This tendency of bad money to drive good money out of circulation was discovered by an English economist named Gresham, and from him it is known as "Gresham's law."

Coins are said to be debased when the government reduces the amount of pure gold or silver in the coin by adding more copper or other alloy. This method of cheating was frequently practiced in earlier days. The money thus became worth less and a new and lower standard became established.

The "48-Cent" Silver Dollar

Coins may at times be worth less as metal or "bullion" than their face value, and yet be accepted at full value because of the confidence that people have in the government. For example, the United States silver dollar has at times been worth only 48 cents as silver, but it was accepted as 100 cents because the United States Treasury stood ready to give gold money for silver on demand. "Fractional currency" (small change in silver, nickel, bronze, and copper) is never worth as metal as much as its face value. The difference between the bullion value of coins and their face value is called "seigniorage," and represents a profit to the government.

Paper money, which has been used for several centuries, is of two general kinds, but the varieties of each kind are very numerous. The first kind is that in which the piece of suitably engraved paper merely *represents* a certain amount of gold or silver coin. A gold coin loses some of its precious metal by rubbing or abrasion if it passes continually from hand to hand. Also, in large amounts it is very heavy to handle. The United States Treasury, for example, puts the gold away in its vaults, and issues gold certificates that represent the gold and serve the same purpose that the gold would serve. Paper money of this kind is said to be backed dollar for dollar with gold.

The other kind of paper money is based on some form of credit. If a bank or a government is trusted (that is, if its credit is good), people will gladly receive its *promises* to pay money in place of the money itself. A "greenback" or United States note is nothing more or less than the promise of the United States government to pay a certain sum of money to the holder of the note. So long as the holder has full confidence in the government, he very seldom demands payment. Instead, he uses the paper currency to buy things, and the man who gets it passes it on. Banks have long issued such "banknotes." At one time in the history of the United States there was a great number of worthless "wildcat" banknotes in circulation, issued by irresponsible banks; but since the establishment of the national banks and Federal Reserve banks, their banknotes are everywhere readily accepted.

Sometimes governments issue too much paper money, just as an individual may promise to do more than he can possibly do. When this happens the notes cease to be taken at face value, and the currency is said to be depreciated or at a discount. In American Revolutionary days the Continental Congress issued vast amounts of paper money, which depreciated so rapidly that the saying "not worth a Continental" was used to express the utter worthlessness of this money. Similarly in the French Revolution paper money called "assignats" was issued which depreciated rapidly; and in the World War period, Russia, Germany, Austria-Hungary, and other countries issued vast quantities of paper currency which was soon worth little or nothing.

All this brings out the well-known theory known as the "quantity theory" of money. Simply stated, this theory is that the value of money in terms of other goods decreases as the amount of money in circulation increases, and the value of the money increases as the amount in circulation decreases. We do not ordinarily speak of the value of money being high or low, but instead say that the prices of goods in terms of money are low or high. The high prices of the period following the World War were due in large part to the increases in credit money that everywhere were found necessary to provide funds for the great struggle. This inflation was much greater in the European countries than in America, which made European moneys of smaller value as compared with that of the United States. Hence foreign exchange could be purchased at very low prices in United States money.

"Making Money"

Even in the ancient city states of Greece coins were usually made by "striking" the smooth gold or silver "blanks" between engraved dies of bronze or hardened iron or steel, one of the dies bearing the design for the face, and the other that for the back of the coin. Only rarely were coins cast in molds, and today casting is the sure sign of the counterfeiter. Beautiful specimens of the ancient coiner's art—the "staters" and "drachmas" of Greece, the "aurei," "solidi," etc., of imperial Rome—are still preserved in our museums, and are the joy and wonder of every true artist. In the Middle Ages the same methods were employed—striking engraved dies or punches heavy blows by hand with a hammer. But the dies were far less artistic, as may be seen in the "bezants" of Constantinople, the "denarii" of the Carolingians, and the silver "solidi" or shillings which were coined everywhere in medieval Europe. The "blanks" were prepared at times by casting, and at times by hammering the metal into sheets on an anvil and cutting out the

There are almost as many kinds of money as there are ways of spending it. Here are only a few examples from people widely separated in geography, time and degree of civilization: 1. Feather money of Santa Cruz (valuable feathers woven into this form for convenience in handling as articles of commerce). 2. Ancient Greek coin, City of Syracuse. 3. Gold sovereign of Henry VIII. 4. Spanish coin, cut into halves and quarters for use as fractional currency by Peru. 5. Swedish square money, 17th century. 6. Lira issued by Pope Pius X. 7. Cowry shell. 8. Wampum, used for ornamental purposes. 9. Coin of the City of Amphipolis (Greek). 10. Head of Hermes, God of Commerce, on the coin of Sybrita, a Cretan City. 11. Coin of Alfred the Great. 12. Chinese Cash. 13. Roman republican coin, Octavian (afterward Augustus). 14. Five franc "Napoleon" 1812. 15. Ten-dollar note of the Confederacy.

contained in the Easy Reference Fact-Index at the end of this work

THE HEART OF UNCLE SAM'S MONEY SYSTEM

This is the building of the Treasury Department, as seen from the Executive Grounds in front of the White House. Although no actual money is made here, this building contains the offices and records of the Treasury, and it is from here that all the financial affairs of the United States Government are controlled.

disks with shears or a round punch. Later the sheets were formed by rolling metal bars between heavy and powerful iron cylinders.

The hand hammer in coining was superseded by the mill and screw press about 1662. This device marks the beginning of modern machine methods of striking coins, which give to every coin exact mathematical uniformity, as well as the "milled" edge which protects the coin from fraudulent clipping or filing of the edges. (For a description of present-day methods of coining money, *see* Mint, United States.)

Paper money must be engraved and printed. Various kinds of paper and various processes are employed by different nations. In the United States, a branch of the Treasury Department at Washington called the Bureau of Engraving and Printing turns out fully $1,000,000 a day in paper money. The paper used is made at the Crane Mills, Dalton, Mass., by a secret process. It is made from the toughest linen rags, and across each and every sheet run rows of short colored silk threads. If you examine the ordinary "greenback," banknote, or silver or gold certificate, you may be able to pull out some of these tiny threads.

It takes about a year to complete the engraved plates for printing a piece of paper money, and as a precaution no one engraver prepares a whole plate. Duplicate plates are made from the original for printing, which is done in sheets. These sheets are later cut up into bills.

The intricate designs, lettering, and pictures or portraits—which are never of living persons—are each separately engraved in relief by specialists who cut each design by hand on a plate of soft steel. The network of fine lines which forms the border is made on the original plates by a wonderful geometric lathe, with many combinations so as to produce many different designs. The original plate is then hardened.

Great precautions are taken against theft or other loss in the printing process. Each bill contains many symbols which tell the initiated what plate it was printed from, who engraved the plate, who printed the bill, etc.

From the time the plates are put in the press it takes about 30 days to complete the intricate process of getting a piece of paper money ready for circulation, during which period it is counted more than 50 times.

The seal on United States paper money—which bears the words *Thesauri Americani Septentrionalis Sigillum*, or "Seal of the Treasury of North America"—is a relic of early days, when it was hoped that Canada would become part of the United States.

In about three years or less after a piece of paper money is started on its rounds of the pocketbooks of the country, it usually comes back to Washington practically worn out. It then goes into a machine called the "macerator," which chews up a million dollars at a mouthful, and the pulp is then molded into various ornaments.

One-half of one per cent of the money going out never comes back. Uncle Sam is the gainer by this, for he will never be under the necessity of redeeming such money with his good gold.

If you tear, burn, or otherwise damage paper currency, you can redeem it at its face value if three-fifths of the note can be sent to the Treasury, and at half its value if less than three-fifths but more than two-fifths is returned. Even bits of bills from a cow's stomach and tiny shreds of paper money from a threshing machine have proved redeemable. (For a list of the coins of the United States, and the chief foreign coins of today, *see* the entry "Coins" in the Fact-Index.)

MONGO'LIA. Between Siberia and China, with Manchuria to the east, lie the vast Asiatic plains and mountain chains of the Chinese dependency of Mongolia, about 1,370,000 square miles in extent. It forms a gigantic basin-like plateau, of 3,000 to 4,000 feet elevation, surrounded by mountain ranges and steppes. The whole region falls into three terraces, of which the highest is the mountainous plateau of northwestern or Outer Mongolia; the second is the great Desert of Gobi (260,000 square miles); the third is the plain of eastern or Inner Mongolia, intersected by the Khingan Mountains. Its chief rivers are the Hwang, a great bend of which flows through the south, and tributaries of the Amur and Yenisei in the north. Its chief city is Urga (40,000 population) toward the northern border, which is an emporium for the caravan trade between Siberia and China.

It is a scantily populated country, with settlements often a day's journey apart. The population, uncertainly estimated at about 2,500,000, consists of Mongols, Chinese, and Tunguses. The winters are harsh and the summers hot, as on the western plains of North America. Vast stretches of fertile land, capable of producing enormous crops, await development. Gold is mined to some extent and there are said to be great deposits of coal and other minerals. The industries are almost undeveloped, cattle raising and transportation being the chief occupations. Outer Mongolia, after the Chinese revolution of 1912, became an autonomous territory under Chinese suzerainty. Inner Mongolia is now practically Chinese territory.

MONGOLS. The story of these slant-eyed nomads, with their flat yellow faces, is one of the strangest in history. A rude almost unknown tribe or group of tribes, learning the art of war in obscure struggles with each other and with their Chinese overlords, they suddenly blazed forth in the 13th century under brilliant military leaders as conquerors of the best parts of Asia and eastern Europe, supplanting native dynasties in one great kingdom after another. Again and again, when the force and ability of the original stock seemed exhausted, fresh and vigorous offshoots renewed the career of conquest. Finally, after making the Mongol name a world terror for several centuries, they have sunk back again into gray obscurity as docile subjects of realms in which they once ruled.

Squat wiry horsemen, hunters, and herdsmen, the tent-dwelling Mongols roved over the cold mountain region south of Lake Baikal and the open steppes, much as the North American Indians roamed over the western prairies before the coming of white men. In the early 13th century Genghis Khan (1162–1227), having welded his wild tribes into a remarkably strong and efficient fighting machine, turned it first against the neighboring Tatar tribes, which he amalgamated with his own, and then against his nominal suzerain, the Kin emperor of China. He took Peking in 1214, and subdued all China except a small portion in the south. Then, turning his armies westward, like nightmare apparitions out of a dim land of fable, against peoples who had never heard of Mongols, he swept over Turkestan, Persia, and the southern part of the Grand Duchy of Kief in Russia. He died in 1227, at the height of his triumph, leaving an empire that stretched from the Amur River and the Yellow Sea to the Persian Gulf and the mouth of the Dnieper on the Black Sea.

The lieutenants of his son and successor, Ogdai Khan, carried fire and sword through Georgia, Armenia, Bulgaria, Hungary, Poland, and nearly all Russia. They displayed, along with frightful ferocity, surprising knowledge of the political affairs of the invaded countries, and a command of military strategy quite beyond that of any European general of the time. The death of Ogdai, and troubles of a disputed succession, recalled the Mongol hordes to Asia and perhaps saved the rest of Europe. Hulagu, a grandson of Genghis Khan, exterminated the Assassin order in Persia, overthrew the califate of Bagdad, massacring the inhabitants of the city (1258), and ravaging Mesopotamia. He destroyed its immemorably ancient irrigation system, and so turned those fertile lands into a desert. Leaving famine and desolation behind, he continued on into Syria. Created governor of Persia by the Great Khan, Hulagu founded a dynasty of practically independent rulers, the Ilkhans of Persia, which lasted until 1353.

The Reign of the Great Kublai Khan

A brother of Hulagu, Kublai, who became Great Khan in 1260, completed the conquest of China and founded the Yuen dynasty, which ruled there until 1368. Sovereign or overlord from the Black to the Yellow Sea, Kublai Khan was ruler over more human beings than had ever before owed allegiance to one man. The first of his race to evince traits of benevolence or magnanimity, or any interest in arts of culture, he had adventurers from as far west as Constantinople and even Venice among his ministers, generals, governors, envoys, physicians, and astronomers. It was during the reign of Kublai Khan that the first reports of the wonders of "far Cathay" came to the ears of an astonished and incredulous Europe through the tales of the returned Venetian traveler, Marco Polo (*see* Polo, Marco).

After the death of Kublai Khan the Mongol Empire fell apart into four, five, and then innumerable fragments; yet there was power even in its decaying members. The most important of these, besides the Chinese and Persian empires, was the "Golden Horde," or empire of the western Kipchaks, which established a suzerainty over Russia which lasted until 1480, when the Grand Duke of Muscovy cast off the Mongol yoke.

In the 14th century a Mongol chieftain of Turkestan, said to be of Genghis Khan's blood, though not a direct descendant, once more erected a huge "empire of desolation" covering Persia, Afghanistan, northern India, Mesopotamia, and the greater part of Asia Minor. This was Timur Leng or Tamerlane (Timur the Lame), whose career was used by the

great Elizabethan dramatist Marlowe as the basis for his tragedy "Tamburlaine the Great." His crowning achievement was his conquest of Asia Minor from the Turkish Empire through the defeat and capture of Sultan Bajazet I in 1402; but like their opponents these Mongols were of Mohammedan faith. Timur's method of dealing with a rebellious city was to level it to the ground and sow barley on its site; pyramids of skulls were "his particular architectural fancy." His power died with him in 1405, though his descendants for a time retained a shadowy authority in Persia.

About a hundred years later one of Timur's descendants, Baber (1483–1530), the exiled and outlawed ruler of a petty kingdom in what is now Russian Turkestan, became through a curious combination of pure chance, imaginative daring, and military ability the Mohammedan conqueror of northern India and the founder of the Mogul (Mongol) empire of India. Akbar, Baber's grandson, who ruled India from 1556 to 1605, showed a genius for rule as well as conquest; more, he was a robust and broad-minded statesman who attempted to create a united India out of its unhappy jumble of warring races and religions. He was not merely one of the greatest of Indian rulers, but "one of the hinges of history." In his reign England first entered into relations with India and he was "the Great Mogul" to whom Queen Elizabeth sent a letter. None of Akbar's descendants came up to his stature or had his vision, though his grandson Aurungzeb extended the limits of the Mogul Empire. But that power was internally decaying at Aurungzeb's death, in 1707, and under his feeble descendants in the 18th century it fell into the hands of English rulers (*see* India).

The Mongols of the present day are one of the chief branches of Asiatic peoples. They are divided into the East Mongols, living in Mongolia and Tibet; West Mongols or Kalmucks, living in Mongolia and Siberia; and Buriats, living around Lake Baikal, Siberia. They are still tent-dwellers and nomadic herdsmen. Most of them are Lamaistic Buddhists; a few are Mohammedans; and the Buriats still hold to their ancient Shamanism.

The name "Mongolian" was given to the yellow branch of the human family because the early students of anthropology took that people as typical of the yellow race. The designation of "Mongolian" is very unpleasant to such peoples as the Chinese.

MON'GOOSE. Every reader of Kipling's 'Jungle Book' knows about Rikki-tikki-tavi, the mongoose (plural, mongooses) who showed such wonderful skill in killing the dangerous cobra snake. These small animals belong to the ichneumon family, which is akin to the weasels, and there are a number of genera and many species, mostly in Africa and Asia. The Egyptian ichneumon was held sacred by the ancient inhabitants of that land, probably because of its usefulness in killing the asp and other poisonous serpents.

HOW THE MONGOOSE KILLS THE DEADLY COBRA

It is hard to explain the wild fury which takes possession of a Mongoose at the sight of a Cobra, that most poisonous of snakes. The little creature bristles and trembles with rage. Approaching softly, the Mongoose makes a feint, leaping forward and away. The Cobra strikes out again and again, but despite the snake's lightning speed, the Mongoose is quicker. Soon the Cobra becomes dazed and uncertain in its movements. At that moment the Mongoose closes in like a flash, seizes the snake behind that great hood and breaks its neck. The Mongoose frequently eats the Cobra's head, poison glands and all. Although he is in no sense immune to the bite of the snake, when the poison is swallowed it does him no harm.

The Indian ichneumon or mongoose is a quick slender animal, about 16 inches long. In spite of its fierce disposition it is easily tamed. When introduced into the British island of Jamaica in the West Indies, the mongoose multiplied so rapidly as to become a serious pest, killing game, poultry, and birds, as well as the rats and snakes which are its natural enemies. With the destruction of birds, many insect pests increased greatly. Accordingly a law passed in 1902 made it a punishable offense to bring a live mongoose into the United States. Scientific name of mongoose, *Herpestes mungo* or *griseus*.

MONITOR AND MERRIMAC. On the afternoon of March 8, 1862, five vessels of the United States Navy lay at anchor in Hampton Roads. Suddenly a queer object appeared coming from the direction of Norfolk, Va., which was in possession of the Confederate forces. Men on board the *Cumberland*, one of the United States vessels, described it as "a long-shore meeting-house adrift." Really it was a reconstructed United States ship, the *Merrimac*, which had been

sunk when the Norfolk navy-yard was abandoned at the beginning of the war. The Confederates had raised the vessel, cut off the sides, covered what was left with iron plates, and renamed it the *Virginia*. This was one of the earliest practical applications of armor to a warship.

The queer-looking object steered straight for the *Cumberland*. It was met by a heavy fire, but when it reached the *Cumberland*, its iron beak cut through the side of the wooden vessel "as a knife goes through cheese." The *Merrimac* next set fire to the *Congress* with red-hot shot from her guns. Then the queer vessel steamed away, expecting to return the next day and finish the work.

But next morning the situation was entirely changed. When the *Merrimac* started towards the *Minnesota*, thinking to dispose of her as quickly as she had her two victims of the previous day, there suddenly appeared in her path a funny little object, about one-fourth the *Merrimac's* size and resembling nothing so much as "a cheese-box on a raft." This was the famous *Monitor*, a Federal ironclad designed by John Ericcson, a Swedish engineer.

The fight between the two queer ships began at once and lasted for nearly four hours. The *Monitor* was more easily handled than the *Merrimac*, but her shots could not do much harm to the other's iron sides. On the other hand, the *Monitor's* single revolving turret offered a hopeless target for her opponent. Thousands of people stood on the shore and breathlessly watched the combat, the distance between the vessels varying from a half-mile to a few yards. Finally as neither could gain a decisive advantage, the *Merrimac* steamed away to Norfolk.

This fight between the *Merrimac* and *Monitor* was one of the most important naval battles ever fought, for it made all the old navies useless. All countries now had to discard their wooden vessels and begin to build ironclads. As one man said, "The wooden walls of England must now be turned to iron."

OUR ACROBATIC COUSINS *of* FOREST *and* JUNGLE

A Visit to the Tropics Where the "Four-Handed" People Live—The Many Tribes that Dwell in Monkey Land, Their Funny Looks and Queer Customs—Differences between Old and New World Monkeys

MONKEY. Can you think of anything that will collect a crowd of children so quickly, or keep them happy so long, as an organ grinder with a monkey? The music is often very dreadful, but the monkey is very funny. His tiny wrinkled face is so comical. It looks like that of a wise little old man who has seen a great deal of trouble. Like a good clown in a circus, a monkey doesn't have to do anything to make people laugh—except just *be* a monkey. He is so wonderfully agile, quick, and clever. He mimics everything people do. He "makes faces," and he dances to music; he runs up the telegraph pole, a tree, or a porch pillar, and he swings from bars like a trapeze performer. He picks up pennies, stuffs them in the pocket of his absurd red jacket, and pulls off his collar-box cap for thanks.

It seems a pity that a monkey can only chatter or scream or scold, for he tries ever so hard to talk. Such a mischief he is, too! If he sees a chance he will snatch a little girl's doll or a woman's hat and tear it to pieces. He knows very well such behavior is naughty, for he scrambles out of reach of punishment, and chuckles with glee over the trick. It's easy to forgive the little rascal, for the next instant he does something engaging. He cuddles his baby, or cracks a peanut like a squirrel, turns a hand-spring for you, or slyly pulls another monkey's tail.

Just what *is* a monkey?

The Great Variety of Monkeys

In the big cage in a menagerie or zoo there are a dozen or more varieties of monkeys as unlike each other as a fox terrier is unlike a St. Bernard dog. Some monkeys are as small as squirrels and others are as large as cocker spaniels. There are monkeys, or apes, with long curly tails, with straight tails, bushy tails, stub tails, and no tails at all. Some have very

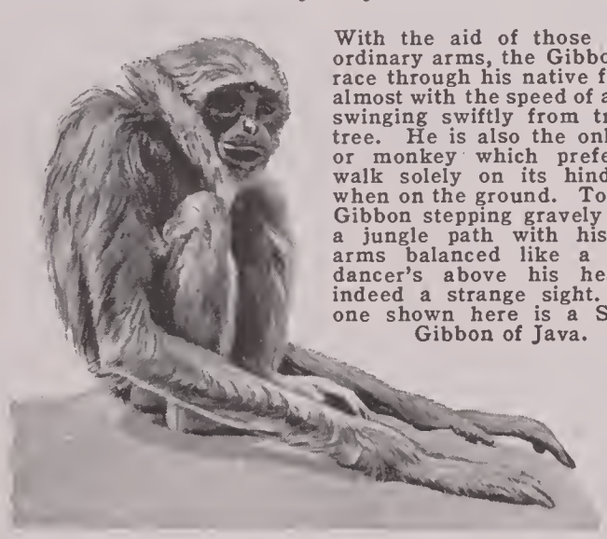
WHAT DO YOU SUPPOSE THESE MONKEYS ARE THINKING ABOUT?

You can almost imagine that they're sitting in a station waiting for a train or lined up in the grandstand watching a baseball game. That first one—the Pig-Tailed Monkey—might well be a serious business man, with no nonsense about him. The Angola Colobus next to him is the very image of an old white-haired lady, who has lost her teeth; and in the middle the Rhesus or "Bandar" of India resembles a mischievous schoolboy in appearance as well as in habits. But what do you think of Number 4, with his puffed-up expression? They call him Humboldt's Woolly Monkey, but you might almost take him for a pompous little lawyer; and right there beside him, peering from under his white eyebrows, sits the gruff and solemn judge — the White-Collared Mangabey.

hairy, and others nearly naked, faces. There are dog-faced and purple-faced monkeys; monkeys with white cheeks, with turned-up noses, with tufted ears, with whiskers, mufflers, and bonnets. Most of them are black, gray, or some shade of brown, from silver-fawn to seal. But there are dandified monkeys with green coats and orange vests.

Many people include the big apes—the gorillas, chimpanzees, orangutans—under the name "monkeys." But this is incorrect. These higher forms are *apes*, and there is a greater difference between the lowest apes and the monkeys than between the apes and man (*see* Ape).

You would not suspect that the word "monkey" comes from *monna*, a contraction of "Madonna," which is Italian for "my lady." The name was given



With the aid of those extraordinary arms, the Gibbon can race through his native forests almost with the speed of a bird, swinging swiftly from tree to tree. He is also the only ape or monkey which prefers to walk solely on its hind legs when on the ground. To see a Gibbon stepping gravely along a jungle path with his long arms balanced like a ballet dancer's above his head is indeed a strange sight. The one shown here is a Silvery Gibbon of Java.

the lower forms of the order Primates (manlike animals) long ago, because of their fancied resemblance to old women.

Monkeys inhabit the warm regions of both hemispheres. They are found in China, Japan, India, and southern Asia to and including the Malay islands, and in all parts of Africa except the deserts. In Europe they are found only at Gibraltar. The New World monkeys are found in the tropical regions of Central and South America, east of the Andes Mountains.

A monkey in captivity is happier in a cage with a number of other monkeys. "The more the merrier" is the rule in monkey land. Nearly every kind of monkey lives in a village in the trees, when he is at home. There is a wise old male for a chief. He and the older males keep trespassers away from a chosen

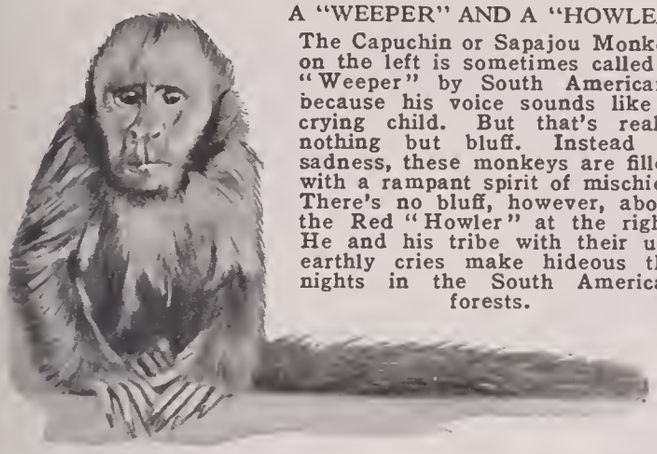
The natives of the Malay Peninsula and of the neighboring islands train young Pig-Tailed Monkeys like this one to climb coconut trees and throw down the ripe fruit. The one here seems like a willing pupil, but when he grows older he will probably develop a fierce and ill tempered disposition.

feeding place, and he leads his followers to a new home when they move. Early in the morning and late in the evening seems to be playtime in monkey town. All the monkeys leap and swing and chase each other through the trees, and "whoop and holler," as Riley says, like so many boys playing in the woods. Spoiled boys they are, too, doing a great deal of mischief by throwing down coconuts and other fruits and nuts, just to see them fall or to vex passers-by.

Some of these monkeys have the prettiest homes! They camp out all the year round. They love the dense woods of very hot countries. In the beautiful tropical forests along the Amazon River of South America, monkeys live in bowers in the trees, among red and green parrots, butterfly orchid blossoms, brilliant insects, and flowering vines. They live in thousands of tropical islands in the sea, among palms and fruit trees. But a few are found in colder countries—in Mexico and in the mountains of India, in Japan and northern Africa, and even around the great fortress rock of Gibraltar, in Spain.

No matter how much monkeys may differ in other things, they are all alike in having four *hands*. The bear, the lion, the elephant, the dog—nearly all the animals you can think of—have four *feet*. Girls and boys have two hands and two feet. A foot has a long

A "WEEPER" AND A "HOWLER"



The Capuchin or Sapajou Monkey on the left is sometimes called a "Weeper" by South Americans because his voice sounds like a crying child. But that's really nothing but bluff. Instead of sadness, these monkeys are filled with a rampant spirit of mischief. There's no bluff, however, about the Red "Howler" at the right. He and his tribe with their unearthly cries make hideous the nights in the South American forests.

sole and short toes, usually, and the toes cannot grasp and hold things. A hand has a nearly square palm, fingers much longer than toes, and a thumb. In the best kind of a hand the fingers have three joints each, and can all be brought together in many positions, and even closed into a fist. All four of a monkey's feet are really hands, with grasping fingers and more or less perfect thumbs. That is why a monkey is so clumsy on the ground. Usually he walks on the outside edges of the palms of his hands, with fingers and thumbs curled in. This gives him a funny bow-legged look. But just watch him on a tree or a perch, or clinging to the wires of his cage. He's as much at home in a tree as a bird or a squirrel.

FEET THAT ARE REALLY HANDS

The big toe of most monkeys is exactly like a thumb, so that they can grasp objects with their feet as well as with their hands.

Even if a monkey cannot talk, he can tell you very plainly where he lived when he was at home—that is, whether he is an Old World monkey, from Asia or Africa, or a New World monkey from South America. The monkeys in a zoo always come to the netting when visitors appear, for they are very curious and want to see everything that is going on; besides, they have learned that some especially friendly little boys and girls carry bags of peanuts. Select any little fellow who comes up to you and give him peanuts, one at a time, as fast as he can take them. If he is an Old World monkey he will stow those nuts away in cheek pouches like a squirrel. He can put a surprising number away, for those pouches stretch and stretch like little rubber balloons. Look at him carefully. His nose, of course, is flat, but the two holes are near together. And when he goes up to a bar to eat his nuts, he does not use his tail in climbing or for holding on.

A South American monkey's nostrils are far apart. He has no cheek pouches, but heaps as many nuts as he can carry in his two front arms, as you carry packages. But he can keep other monkeys from taking his nuts when he climbs, for he uses his long curly-tipped tail for a fifth hand. With *five* hands for grasping, the South American monkey is a wonderful trapeze performer. The tree-squirrel climbs faster, the flying squirrel leaps farther, the bat clings better with his wing-hooks; but no other animal can climb, leap, *and* swing across a wide forest, 40 feet from the ground, the way the South American monkeys can. "The acrobats of the animal world," they seem to be made up of wire springs that are tireless.

SOME QUEER STYLES OF MONKEY LAND

On the left is a "White-Eared" Marmoset. You can see plainly why they call him that. Hs is a delicate timid little creature whose home is in Brazil. On the right is Humboldt's Saki, a native of the upper Amazon. His general color is black with a gray grizzle of white-tipped hairs mixed through the black. He looks as if he had upset a pail of whitewash on himself and was worried about it.

They do not leave the trees except in case of necessity, and they drink while clinging to a bough which overhangs the water. They feed on leaves, fruits, insects, eggs, the young of birds, and on honey. American monkeys seldom damage man's productions, but they are hunted for their flesh and fur.

The South American monkey that you see oftenest with the organ man is a small rusty-brown animal, about as big as a toy terrier. He has a curved hair-covered tail, good thumbs, a rather pleasant whistling chatter, and a careworn anxious face, as if he expected nothing in life but bad news. He is bright and obedient, so he soon learns his tricks and performs them willingly. He likes to ride on a dog's back, on his master's shoulder, or on the organ. Another favorite of the organ man's is the Capuchin monkey. You may know him by the queer way in which the hair grows around his face, like a hood or cowl of a Capuchin monk.

Sometimes in school you learn a rule, and then the teacher will tell you that there are times when the rule doesn't work. The marmoset, the smallest and prettiest of all South American monkeys, cannot use his tail in climbing. When children see the marmoset they always cry: "Oh, what a little dear!" He is no bigger than a chipmunk. He is only eight inches long, with a furry body and a foot-long bushy tail that he carries like a plume. If it wasn't for his almost human little face and hands, and his winglike tufted ears, you might think him a squirrel.

A SOUTH AMERICAN "SPIDER"

Spider Monkeys are among the nimblest folk of the tree tops. And indeed they look very much like huge five-legged spiders, with their long thin arms and legs, and powerful tail.

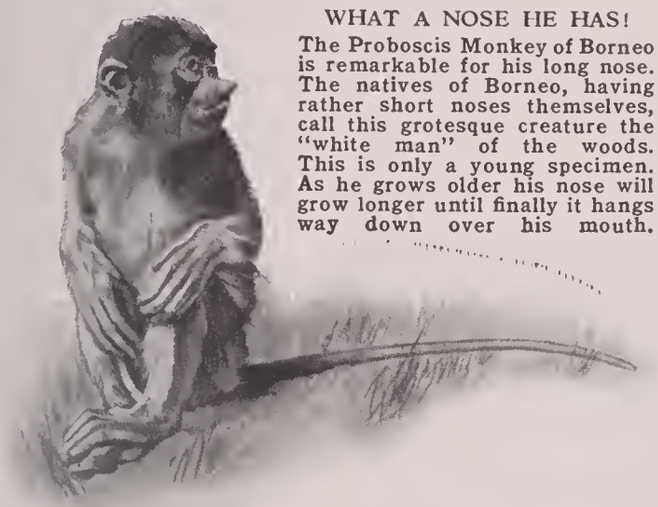
There is a squirrel monkey from South America only a little larger than his nut-cracking namesake. He has a gray face and a black nose, but has long hind legs, so that he leaps somewhat like a kangaroo. When he is happy he shows it by grinning, and when he is hurt tears come into his eyes. In his home in the Amazon forests it rains torrents sometimes, as if the bottom had fallen out of the clouds. When caught in such a storm a troop of these squirrel monkeys huddle together in the thickest tree they can find, and put their tails around each others' necks for company and comfort.

These marmosets and squirrel monkeys have some of the noisiest neighbors—the "howling" monkeys. They have a larynx or voice box with six pockets, which reflect the voice and give it unusual strength. They begin howling at sunrise, keep it up until the next sunrise, and then take a fresh start. The woods ring and echo with their howls. They travel all the time through the high branches of the trees, the males leading and the mother monkeys following, each with one or two babies clinging to her neck with fingers and tails. They swing by their tails and catch the next limb with a hand. The brown howler is bad enough, but the red howler makes the night hideous with his cries. They screech as if all the animals in the forest were eating one another up. Some zoos won't have little-old-man-howler, as he is called, at all. He disturbs the other animals, and is altogether too much of a nuisance.

THE SACRED GRAY "PEOPLE" OF INDIA

The Hindus look upon the Hanuman Monkeys as the living representatives of one of their gods, and so protect them from harm. The result is that these mischief makers gather about Hindu villages in family groups like this one, and live luxuriously off the farmer's crops. Sometimes when the Hanumans threaten to eat everybody out of house and home, the desperate villagers go out, and, with many apologies, capture the tame monkey folk and deport them far into the jungle, treating them meanwhile with the tenderest care.

Another South American monkey is the saki. He has a ruddy back, and an almost human habit of cupping a hand and dipping up water when he wants to drink. He is so delicate that he seldom lives long in captivity, so you may never see him. But you are sure to see the spider monkey. He has such long slim arms and tail and such a small body that he looks like a big, hairy spider. But really he is very gentle and even affectionate. He has little stumps of thumbs that are of little use to him and he is not as agile as many other monkeys. A mother spider monkey likes to sit down and cuddle her baby in her arms.

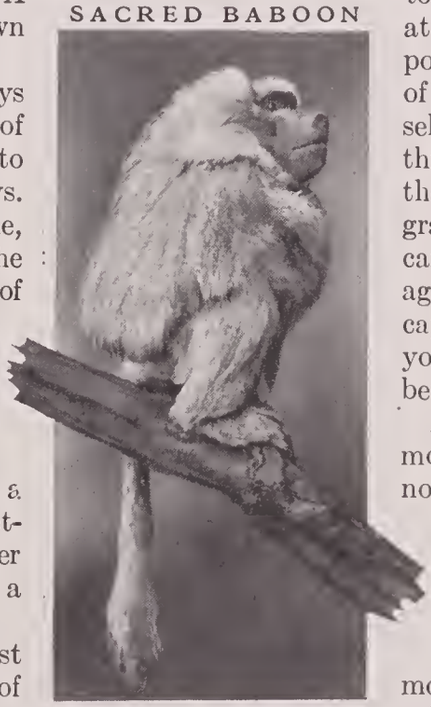


WHAT A NOSE HE HAS!

The Proboscis Monkey of Borneo is remarkable for his long nose. The natives of Borneo, having rather short noses themselves, call this grotesque creature the "white man" of the woods. This is only a young specimen. As he grows older his nose will grow longer until finally it hangs way down over his mouth.

So many of the Old World monkeys have only little stubs and lumps of thumbs that scientists put them into one family of "cut-off-thumb" monkeys. If you see a monkey with a very fine, long-haired silky coat, particularly if he has cheek pouches and makes no use of his tail, look for shrunken little thumbs. His coat makes pretty monkey-skin collars and muffs. One monkey of the mountains of Abyssinia, where it is cold, looks as if he were wearing furs himself. He has a fringe of white down either side his jet-black velvet body, a white tippet under his chin, a white edge to his cap, and a white tip to his tail.

SACRED BABOON



Pictures of this dog-like creature are found in great numbers on monuments of the ancient Egyptians, by whom he was held sacred. He dwells mostly in Arabia and Abyssinia, and is also called the "Mantled" Baboon because of the long mane worn by the males.

Another monkey of the hot west coast of Africa wears the hair on top of his head in a crest, with a parting on each side, something like the way grandma used to comb your papa's top hair, in a long fat curl called a "roach." This crested monkey looks very comical indeed, for besides his roach he has whiskers under his chin. A near neighbor of his in the African jungle is the "face-maker." He is a very good-tempered teachable little fellow. The variety of queer faces he can make always draws crowds, so he is always a great favorite with organ men, circuses, and zoölogical gardens.

A FAVORITE PET OF CEYLON

The Bonnet Monkey—a member of the Macaque group—is a native of Ceylon and southern India. He is frequently seen in the company of street strollers in India, Japan, and northern Africa. The queer arrangement of the dark hair on his head, which resembles an old woman's bonnet, is responsible for his name.

The guenon is the most sympathetic of African monkeys. It is commonly found in zoölogical gardens. It is a small graceful creature with fine hands, long thumbs and tail, big cheek pouches, and large hairless parts called callosities. It is a lively, merry monkey. It lives in troops under the leadership of an old, experienced guenon, and when a raid on a cornfield is made, this master leads, and the females follow, carrying their young. They travel in tree-tops until the field is reached and descend at a signal of the leader. The cheek pouches are quickly filled; then the rest of the crop is wasted in an attempt to select the choicest ears. If danger threatens during the raid the leader gives the signal for retreat, each mother grasps her child and as much corn as she can carry, and all take to the tree-tops again. With proper care they thrive in captivity and give tender care to their young and the weak and helpless members of their kind.

Among the brown and gray and black monkeys in a zoo, you will be sure to notice any that are brightly colored. There are a red- and a purple-faced monkey; a Diana monkey, with a pretty white crescent like a new moon on the forehead, a white beard and neck scarf; and a monkey with a blue mustache above yellow whiskers — he is called the "mustache" monkey. The green monkey, whose home is in the region of the Nile, is quite a dandy. He is dressed in dark green and black, set off with dull orange whiskers, throat band, breast-plate and tail-tip. He was introduced into the Lesser Antilles some 200 years ago.

At first sight the hanuman monkey of the East Indies doesn't look especially interesting. He is a little spider-legged animal three or four feet long, with cream-colored fur and black hands and face.

But he is a privileged being. In his native land he is sacred to Hanuman, the monkey-faced god. He is never interfered with, so he goes in troops into the villages, helps himself to grain, fruits, and nuts in shops and houses, and destroys things from wanton mischief. The people of India are so kind to all living creatures that several "bad boy" monkeys are very troublesome. Stories are told of whole tribes of the hanuman monkeys swarming into dining rooms and eating wedding feasts. The Hindus have a legend that Hanuman, with the aid of a monkey army, helped rescue the wife of the divine hero Rama from a demon. Another legend is that Hanuman brought men a stolen gift, the mango, a valued Indian fruit. For the theft the monkey was condemned to death by fire; but it escaped with only its hands, feet, and face burned, and these have been black ever since! In some Hindu communities these monkeys live in the top stories of the homes of the natives. If one native bears another a grudge, he places rice or corn on the enemy's roof during the rainy season. When the monkeys see this they eat the grain that is within reach, then tear up the tiles of the roof to secure the particles which have fallen into the crevices, so the house is opened to the rain.

THE HIDEOUS MANDRILL

Among the most repulsive looking creatures in the world is the Mandrill, a species of Baboon inhabiting West Africa. Stump-tailed, unshapely, with a fierce glowering aspect, this creature is further disfigured by swellings on its face which are colored a vivid red and blue.

Another mischievous monkey is the magot, who lives in northwestern Africa and in Spain around Gibraltar. He is about as big as a terrier dog. He and all his relations go to a fine garden and set sentinels in trees and on rocks to watch, while the others eat and destroy melons, figs, grapes, oranges, and almonds. An alarm sends them flying. This bad habit lands many of them in zoos and traveling shows, because traps are set for them.

The street strollers of India, Japan, and northern Africa lead about the macaque (*mȧ-kăk'*) or "bonnet" monkeys. They are sturdily built, with short tails. The hair of the macaques grows in a frill around the face. These sunbonnet babies are quick and clever. One of them loves crabs so well that he has learned to swim and dive for his favorite food. The pig-tailed bonnet monkey of the East India Islands is used on plantations to climb up the tall palms to pick coconuts.

In the East Indian island of Borneo is found the long-nosed or proboscis monkey. In structure this is a slender monkey with the nose of the adult male long and beaklike. His nose is not only movable in all directions, but it can be retracted or protruded at will. One might venture to call him the "telescope-nosed" monkey! The fur is red, thick, and soft, and about the neck it is nearly a foot long, forming a heavy collar.

The baboons, or dog-headed monkeys, are among the ugliest and most repulsive members of the monkey tribe. In size and habits they come between the apes and the tree-dwelling monkeys. They are made especially hideous by large bare callous spots, often brilliantly colored. Their long blunt muzzles, with nostrils at the extreme end, and the great canine teeth give their faces a doglike appearance. They run swiftly on all fours and climb trees with difficulty. They hunt in great droves, and, led by their old males and guarded by sentinels, often defend themselves against other wild beasts. Their food is chiefly insects, small animals, vegetables, and fruits. In their raids on plantations they often work great havoc.

About a dozen different kinds of baboons are known, of which the mandrill is the largest and fiercest. This brute, said to be the most hideous of all animals, is larger than a mastiff; it has short legs, a heavy body, immense canine teeth, and a stump of a tail less than two inches long. It is especially remarkable for the brilliant flower-like hues of the hairless portions of its face and body. Its cheeks are an intense blue, while the central line of the nose is a brilliant scarlet.

The powerful hamadryad (*hăm'ȧ-drī-ăd*) baboon of Arabia and northeastern Africa was worshiped by the ancient Egyptians, and its solemn appearance gained it credit for great wisdom. It is remarkable for the shaggy coat of grayish-green hair that covers its head and shoulders, and the flaming red of its callous spots.

Amazing stories are told of the intelligence of the chacma baboon of South Africa, which is nearly as large as the mandrill, but is much more gentle in early life. In several instances chacma baboons are said to have been trained to act as shepherds, driving their woolly charges to and from pasture and protecting them with passionate devotion. One of their well-authenticated traits is a lively and self-sacrificing love for helpless creatures dependent on them, so that in defense of their young or their females they do not hesitate to attack leopards, pythons, and even men. Their span of life is thought to be nearly equal to that of human beings.

Scientific name of New World family, *Cebidae;* Old World family, *Cercopithecidae;* marmoset, *Callithrix* (genus); guenon, *Cercopithecus* (genus); Capuchin monkey, *Cebus capucinus;* white-headed saki, *Pitchecia leucocephala;* spider monkey, *Ateleus paniscus;* macaque of Japan, *Macaca speciosa;* baboon, *Papio* or *Cynocephalus* (meaning "dog-headed"); hanuman monkey, *Pygathrix entellus;* howlers, *Alouata* (genus); squirrel monkeys, *Saimiri* (genus).

For any subject not found in its alphabetical place see Index

TALES THE WOODMAN TOLD

ADVENTURES OF HOWLER THE MONKEY

People used to stand in front of Howler's cage and laugh at his tricks

"WOULDN'T it be fun," said Little Boy one day, "to be a wild animal and still know as much as we do now? Just think, I could be King of the Jungle, and the lions and the tigers and the elephants would all have to do exactly as I told them."

The Woodman Who Was Wondrous Wise squinted along the edge of the ax he was sharpening, and smiled. It was an afternoon late in the fall, and they were both sitting by a crackling camp fire under the big oak tree near the Minnow Pond.

"I heard of a case very much like that once," said the Woodman. "In fact you might say it amounted to the same thing. Only it wasn't about a little boy. It was about a young monkey. If you'll throw some sticks on the fire I'll tell you the story."

Little Boy quickly tossed an armful of sticks into the blaze, while the Woodman lighted his pipe with a glowing coal.

"The story begins in a circus in New Orleans," said the Woodman. "And as I remember it the monkey's real name was Alouata Belzebul. Leastways that's what he was called by the old man with the big round glasses who had caught him in the forests of Brazil. But mostly he was just called Howler."

"That's a funny name," said Little Boy.

"Just the same it fitted him mighty well," said the Woodman. "And the people in the circus—the clowns, and the beautiful lady who rode the white horse, and the man who lifted the big weights, and the seven acrobats—they didn't think it was so funny, for Howler used to sit up nights to howl. And let me tell you, Little Boy, when a Howler monkey howls, no one can sleep for a mile around.

"Well, anyway, crowds of people used to stand in front of Howler's cage and laugh at his tricks, for he had learned lots of clever

"The story begins in a circus in New Orleans", said the Woodman

things. And Howler used to hang by his long tail from a bar and think what a wonderful fellow he must be to attract so much attention.

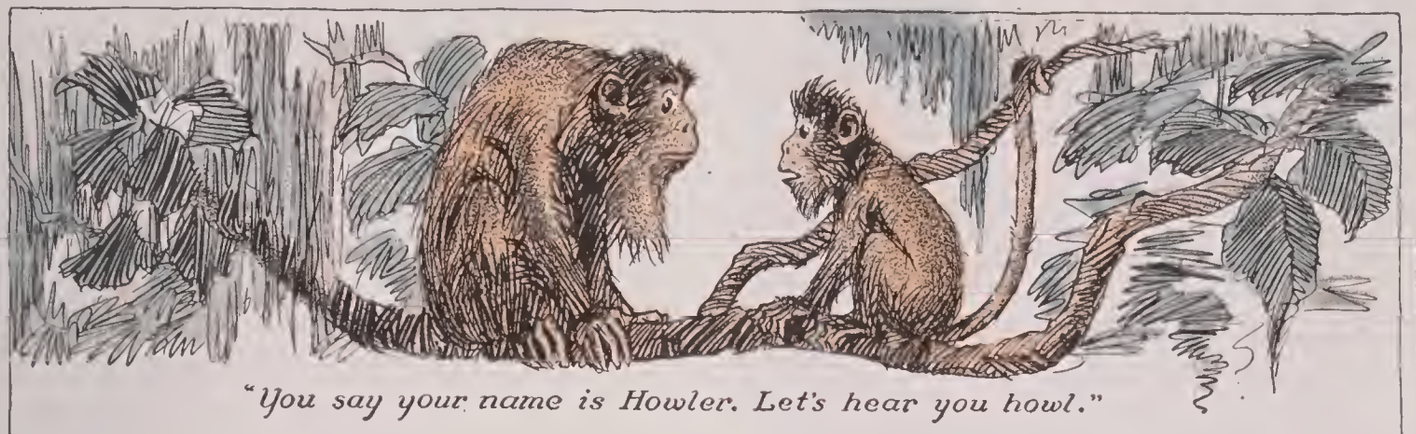
"But finally the circus people couldn't stand Howler's howling any longer, and he was sold to a ship captain who admired his wonderful skill in tying knots. 'He's a born sailor,' said the captain. 'I'll take him to sea.'

"I won't stop to tell you the adventures Howler had on board ship. But he got to thinking more and more highly of himself, and one evening when the ship was anchored in the harbor of Para in Brazil, Howler just skipped over the rail and escaped. In one way and another he managed to travel up the banks of the Amazon until he reached the big dark forests where the trees and vines are so thick the sunlight hardly ever reaches the ground.

"One night Howler had cuddled down in a forked branch to sleep and the big dark forest was as quiet as a church. Suddenly toward morning he was wakened by the most terrible noise he had ever heard. It sounded as if all the wild beasts of the whole jungle were roaring and screaming in frightful rage. Howler trembled like a leaf, when the noise stopped just as suddenly as it had begun and two dark figures laid hold of him roughly and dragged him to the top of the tree.

One evening Howler just skipped over the rail and escaped

"Who are you?" asked the gray-haired one



"You say your name is Howler. Let's hear you howl."

"The sun was just rising, and Howler saw that he was in the center of a circle of monkeys very much like himself. Leaning back on a branch in the middle was an old gray-haired monkey who looked at Howler severely.

"'Who are you?' asked the gray-haired one.

"'I'm Howler from the circus,' replied the newcomer. 'The man who stood in front of my tent used to tell people I was the most wonderful monkey in the world. I can tie knots and I'm something of an acrobat, if I do say so myself.' And Howler threw out his chest a little.

"'I don't know what you're talking about,' said the old monkey stroking his beard in a bored way. 'But you say your name is Howler. Let's hear you howl.'

"Howler drew a long breath and let out a howl louder than any he had ever let out in his life before, but the old monkey laughed at him. 'That's just a whisper,' he said. 'Why don't you howl like this?' And then the old monkey opened his mouth and roared so loud Howler nearly fell out of the tree.

"'Can you travel through the trees like the wind?' was the next question.

"'I told you I was an acrobat,' replied Howler.

"'Then follow me,' the old monkey said, and swinging suddenly down by his tail, he threw himself across an open space to a branch ten feet away. Howler tried to do the same thing, but fell short and crashed to the ground with a tremendous thump. All the other monkeys laughed long and loud. When poor bruised Howler climbed back into the tree, he was told to fall in line with the mothers and children and the whole tribe started through the forest, the gray-haired one leading the way. The mother monkeys, carrying their little ones on their backs, made fun of him and Howler felt very unhappy.

"The next day his pride came back a little. He decided he would show them all what he could do. Pretty soon he saw a herd of animals rooting around a tree. They looked just like the pigs he used to ride in the circus. He dropped down quickly and jumped on the back of the nearest one. There was a tremendous rushing and snorting and

There was a tremendous rushing and snorting and gnashing of teeth

One night after the midnight song it was found that Howler had tied the tails of the singers together

squealing and gnashing of teeth, and Howler felt as if a hurricane had struck him. He thought his last hour had come, when suddenly he was yanked upward and landed on a branch with a jolt that nearly shook his teeth loose. The old gray monkey was holding him tight, while the beasts below reared up and tried to reach him, snapping their jaws and blinking their little red eyes.

"'Don't you ever do that again!' roared the old monkey, shaking a finger in his face. 'Where were you brought up? Didn't your mother ever tell you that the peccary is more dangerous to monkey folk than the jaguar or the alligator?'

"'I never had a mother,' said Howler meekly, 'and I used to ride pigs in the circus.'

"The story of this blunder made all the monkeys for miles around laugh more than ever, and the little ones used to say: 'Hullo, Howler! Have you been riding a wild pig this morning?' It drove him almost mad. Everything he'd learned in the circus seemed to turn out wrong in the big forest. When he pulled the tail of a sleeping jaguar, just as he used to pull the tails of the lions and tigers through the bars of their circus cages, he was only saved from certain death by a mad dash up a tall thin tree. The rest of the monkeys used to say: 'Oh, that's just another of Howler's foolish tricks.'

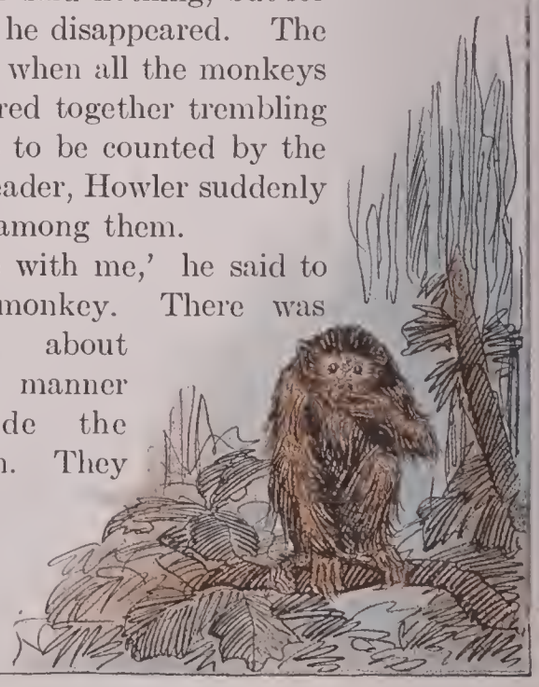
"One night after the monkeys had finished their midnight song, and were starting to bed, it was found that Howler had tied the tails of all the singers together, two and two, and the knots were so tight that it took half the night to get them undone.

"For this outrageous trick, Howler was chased out of the tribe entirely and had to live by himself. But he used to creep around and listen to their talk, for he felt lonely. One evening he noticed all the monkeys looking very sad. They were gathered in small groups, whispering to one another and looking around as if they were in some deadly fear. At last he managed to overhear what it was all about.

"It seems that there was a big snake—an anaconda—that had been killing and eating monkeys from that tribe for many generations. He lived on a great tree near the water and every month, during the new moon, five monkeys would disappear, and all the members of the tribe knew they had been swallowed by this horrible snake. And now the new moon was only three days away.

"Howler said nothing, but for two days he disappeared. The third day, when all the monkeys had gathered together trembling and silent to be counted by the big gray leader, Howler suddenly appeared among them.

"'Come with me,' he said to the old monkey. There was something about Howler's manner that made the tribe listen. They



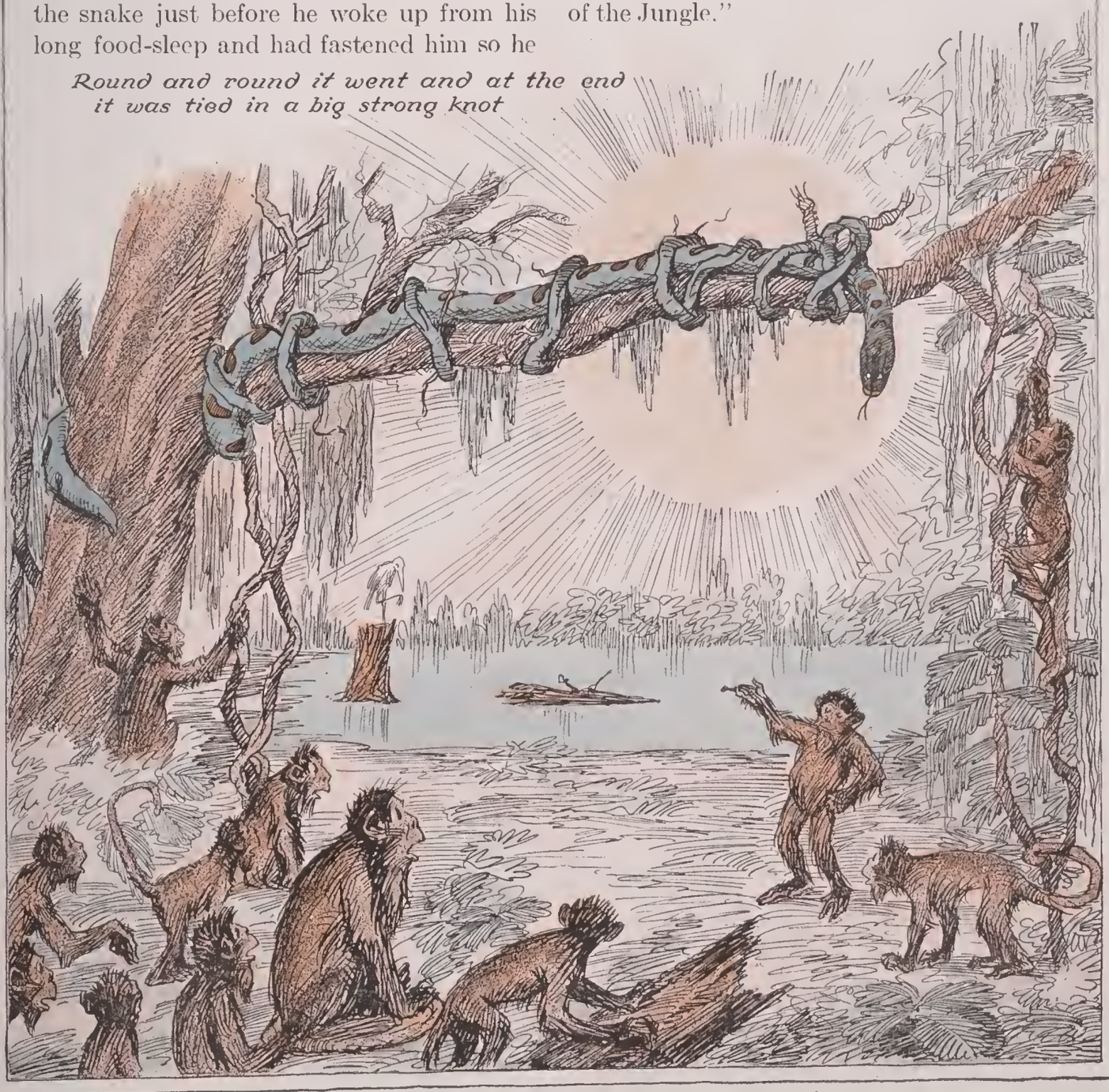
followed, and saw that he was leading the way to the snake tree by the river. They wanted to turn back, but Howler called them and they followed in spite of their fear.

"When they reached the terrible tree and looked down through the branches, they saw the strangest thing they had ever seen. The big snake was there, lying on his usual branch, but he was absolutely helpless. For winding around him and the branch was a long tough vine. Round and round it went, and at the end it was tied in a strong knot, the kind of a knot Howler had seen sailors use in making ships fast to the wharf.

"Then Howler told how he had found the snake just before he woke up from his long food-sleep and had fastened him so he could never escape. The terrible danger was over, the tribe could be happy again, and Howler was a hero. The old chief called Howler to his side, and made him his adopted son. And when the old monkey died, Howler became the chief and ruled wisely for many years."

"I wish I had been in his place," said Little Boy as the story ended.

"Yes," replied the Woodman. "Howler came out all right in the end. But still his story shows that even if you suddenly became a wild animal and knew as much as you do now, you might have to learn one or two things more before you could be King of the Jungle."



Round and round it went and at the end it was tied in a big strong knot

LIFE *in* CELL *and* CLOISTER

Melrose Abbey—what memories must live in these venerable stones! Can you not imagine that on moonlit nights the spirits of the old Cistercian monks revisit the ruins of their historic monastery? Can you not see them marching out to the fields to work, their robes girded up above their bare legs? Can you not hear the solemn midnight chants in the moss-grown chapel? Or perhaps it is the tramp of shouting men-at-arms with torches and glittering weapons, for three times after it was built in 1136 was this famous Scotch monastery burned down by English soldiers. Celebrated in the writings of Sir Walter Scott, Melrose Abbey is today preserved as part of the estates of the Duke of Buccleuch.

MONKS AND MONASTICISM. The word "monk" (from the Greek *monachos*) originally meant a solitary, or one who lives alone, but in course of time it came to mean a member of a religious community. Similarly the word "monastery" meant a cell or hut, and then came to mean a community of men or women devoted to the service of God and obeying a fixed rule. In the early days of Christianity there lived in the great Egyptian desert called the Thebais numbers of solitaries or "hermits" (from the Greek, *eremites*, "a dweller in the desert"). The most celebrated of these was Paul of Thebes, who lived toward the middle of the 3d century. These hermits were remarkable for their self-denying or "ascetic" mode of life.

The first monastic organization dates from the year 305, when Saint Anthony established a monastery at Phuim, on the banks of the Nile. This, however, was not a monastery in the strict sense, as the brethren lived in separate huts, and though under Saint Anthony's direction, they lived a life which was largely suggested by individual fancy. The first community of monks living under a common roof was established by Pachomius in the year 340, at Tabenna, an island of the Nile. He compiled the first monastic rule. The difference between the monks under the guidance of Saint Anthony and those under the direction of Pachomius was chiefly this, that the former spent all their time in the reading of the Scriptures, in prayer, and works of mortification; while the latter led an active life in which religious exercises and the reading of the Scriptures alternated with daily labor in the fields.

This picture, like others in this article, is reproduced from ancient drawings made by the monks themselves. It shows a Benedictine of the Middle Ages. Hard work was the guiding motto upon which was founded the Benedictine order. Its members were formerly known as "Black Monks" from the color of their robes.

From Egypt monasticism spread into Asia Minor and Syria; and about the year 360 Saint Basil established a great monastery near Neo-Caesarea, in Pontus. He is regarded as the founder of Eastern monasticism, of which the famous monastery at Mount Athos is the modern representative. Saint Basil laid down the principle that the monk must not live for himself alone, but must do good for his fellow-man. In order to give his monks an opportunity to put this into effect he established hos-

For any subject not found in its alphabetical place see information

pitals, hospices, and orphanages near the monasteries under his care. He also provided schools for the education of boys, not necessarily with a view to their becoming monks. He discouraged excessive asceticism, and taught that work is of greater value in the monastic life than self-imposed mortifications or punishments. Accordingly, the time of the monks was divided between prayer, good works, and the reading of the Scriptures.

Monasticism was imported into Italy directly from Egypt at an early date, and monasteries of men and women soon became numerous throughout the Italian peninsula, especially in the neighborhood of Rome. Thence it spread into Gaul, where Saint Martin of Tours founded the monastery of Ligugé, near Poitiers, in 360. Even more celebrated than Ligugé was the monastery of Lérins, which gave to the church of Gaul some of its famous bishops and saints. Saint Patrick, the Apostle of Ireland, was trained there. There is little known of Spanish monasticism before the close of the 5th century; but there were many great monasteries in Wales and Ireland, each with many hundred monks. Undoubtedly the chief glory of Celtic monasticism is its missionary work, the results of which are to be found all over northwestern Europe.

The Cistercians, or "White Monks," were established under rules even more austere than the Benedictines. The Trappists, a later branch of the order, are noted today for the privations to which they subject themselves.

The greatest name in the history of western monasticism is that of Saint Benedict of Nursia, who was born about the year 480. His 'Rule' set forth the details of the monastic life in a way that had never been done before. According to Saint Benedict's idea, the great disciplinary force for human nature is work; idleness is its ruin; work is the first condition of all growth in goodness. Even prayer comes after work, for grace meets with no coöperation in the heart of the idler. When the Goth went to visit Saint Benedict in his monastery at Subiaco, he gave him a bill-hook and sent him to clear away briars to make a garden. "Go and work," was his advice. He taught that work is not the duty of slaves; it is the universal lot of mankind, necessary for his well-being as a man, and essential for him as a Christian. The religious life as conceived by Saint Benedict is essentially social, where prayer alternated with social duties.

The influence of Benedictine monasticism was evidenced in many ways during the Middle Ages—in the conversion of the barbarians and the civilization of Europe; in the development of agriculture, for it has truly been said by a great historian that the Benedictines were the agriculturists of Europe; in the cultivation of learning and the teaching of crafts and trades, such as painting, wood carving, working in metals, carpentry, weaving, tailoring, the tanning of leather, and clock-making. English Benedictines were the greatest clock-makers of the 14th century; and one of the most wonderful clocks ever devised was the work of Peter Lightfoot, a Benedictine of Glastonbury. This clock, now in the South Kensington Museum in London, was formerly in the tower of Wells Cathedral in Somersetshire.

Nearly all the great orders of the Middle Ages were founded on the Benedictine plan, though differing in certain details. The most notable of these were the Carthusians, so called from the Grande Chartreuse near Grenoble, in France, founded by St. Bruno in 1086; the Cistercians, or "White Monks," founded by Saint Robert Molesme, in 1098 (now known best as Trappists); and the Premonstratensians, or "White Canons," named from Premontré, in France, founded by Saint Norbert in 1120. The Benedictines were formerly known as the "Black Monks," from the color of their habit.

The monasteries were all self-contained communities and as a rule were divided into abbeys and priories, of which the abbey church was the central figure. Around this were grouped the numerous buildings constituting the monastic compound. Our English word "minster" derives from monastery, through the French; we find it still in use in such designations as Westminster Abbey, York Minster, and elsewhere.

In all monastic churches the plan was governed by certain common necessities: (1) A choir had to be provided for the chanting of the "canonical hours" by the monks. The canonical hours are fixed forms of prayer which every Catholic priest is bound to recite daily, viz., matins, lauds, prime, tierce, sext, none, vespers, and compline. (2) A sufficient number of altars was necessary, so that the priests of the monastery might be able to celebrate mass at fixed hours. (3) Arrangements had to be made for processions which were held every Sunday.

Next in importance to the church was the cloister, which, as its name implies, was an inclosed space, surrounding all four sides of a rectangular court known as the "garth." The four walls of the cloister were roofed in. Here the older monks labored at appointed duties, such as the copying of manuscripts and writing; here, too, the younger members of the community toiled at their studies under the direction of teachers. Then came the refectory, or as it is called the "fratry"

or common dining-hall, which was always located at some distance from the church. The floor of the refectory was covered with straw or rushes changed three or four times in the year. Close to the refectory was the kitchen. The dormitory usually was near the cloister. In early times it was simply an open apartment without screens. Later, partitions were introduced, and each monk had a small room where he studied as well as slept.

A most important feature of every monastery was the infirmary, or house for the sick and the aged. It was placed near the dormitory and close to the garden, or "herbarium," where herbs used in compounding medicines were cultivated. The care of the sick was especially enjoined upon the superior of every monastery by the Benedictine Rule. A guest-house was a necessary part of the establishment; and near the gate of the monastery there was invariably a shelter for travelers. Every religious house had an almonry, or place where the poor could receive alms, in the name of Christ. To the almonry was usually attached a free school for poor boys. Near the cloister there was a common-room or "calefactory" (warming place) where the monks might resort in winter to warm themselves at the common fire, which was lighted on the Feast of All Saints, November 1, and kept burning daily till Easter.

The Carthusians, except on special occasions, eat but once a day and then of the coarsest food. To mortify the flesh they wear rough hair shirts. They live in separate little houses like the ancient monks of Egypt, and spend their time reading, praying, and laboring with their hands.

Libraries as we know them today were not found in the old monasteries; but manuscripts and copied books were carefully preserved in lockers or cupboards in the church or in the cloister. By the 15th century, however, libraries were common, many of them very large and splendidly arranged, with "cubicles" or small writing rooms. In addition to the foregoing parts of the monastery there were numerous buildings set apart for various kinds of work, such as carpenter shops, book binderies, forges, mills, bake-houses, and barns. All of these were under the supervision of a chamberlain, or procurator.

All the inmates of a monastery were under the government of an abbot (from the Latin *abbas*, "father"), whose authority was supreme. Next came the prior; and then his assistant, the sub-prior. There were several officials known as *obedientaries*—such as the cantor, or singer; the precentor, or chief librarian and archivist; the collarer, or bursar; the refectorian; the kitchener; the infirmarian; the almoner; the chamberlain; and the novice-master. The position of abbot was one of great power and influence.

The daily life of a monastery was minutely ordered. The day between sunrise and sunset was divided into 12 equal parts or *horae*, and likewise the night, or from sunset to sunrise, into 12 equal *horae*. The hour for rising was about 2 a.m. On rising the monks went to the church, or oratory, for the vigils or night office, matins, and lauds. Meditation and other prayers followed. Prime was said at sunrise, after which they went to their appointed work till 10 o'clock. Tierce was then said; and from 10 till 11:30 they read. Then sext was recited; followed by dinner, which was over shortly after midday. The dinner, or *prandium*, consisted of vegetables, possibly eggs, perhaps fish, salad, bread and wine; but no meat was allowed. In Italy there followed a *siesta* or afternoon nap; but elsewhere the monks went to the fields, the shops, or the bake-house and worked until vespers at 5 o'clock. Supper, or the *coena*, was at 5:30; then the reading of the "collations," and compline, and to bed at 6:30, often while it was still daylight.

We must distinguish "monks" from "friars" (from the French *frère*, "brother") though both are called Religious Orders, or "Regulars," as distinguished from the "Secular" clergy. Seculars are not bound by the vow of poverty as are Regulars; they follow no special rule, and may hold property as individuals. Retirement from the world and solitude are the essential characteristics of monks; hence it is that monasteries are located away from cities or towns in some secluded spot. Friaries are usually found within or near city limits, as the friars engage in parochial and other ministerial work, and come in close contact with the outside world. Friars originally depended on alms or offerings of the people for their subsistence; hence the term mendicant (from the Latin *mendicare* "to beg") was formerly applied to them. The chief orders of friars are the Dominicans ("Black Friars"), the Franciscans ("Gray Friars"), Carmelites ("White Friars"), and the Augustinians.

Among these the Franciscans are perhaps the best known in American history, for it was the Spanish members of that order who founded the many early Indian missions in the New World, penetrating Arizona and New Mexico as early as 1539. (*See* Francis of Assisi.) The Dominican friars form a preaching and teaching order, with many communities in America.

It may be asked why men and women leave the world to enter a religious community. Briefly, a

THE VESPER HOUR AT THE MONASTERY

What poet could better express the serenity and quiet beauty of the monastic life than the camera has here done in this view of a venerable monk among the graves of the dead at the vesper hour in the Franciscan mission of San Luis Rey, California?

contained in the Easy Reference Fact-Index at the end of this work

THE LIFE OF TOIL AND PRAYER

Like the Benedictines, the Cistercians keep their time well occupied with toil, particularly as farmers and gardeners, both orders believing that idleness is a great source of evil.

Catholic believes they do so the better to practice the counsels given by Christ as set down in the Gospels—the renunciation of wealth, worldly pleasures, ambition or self-seeking, and the rendering of greater service to God and humanity. These are the motives which have induced and still induce multitudes to embrace the "religious" life.

In the early days of Christianity women vowed to the service of God lived in their own homes, and at a later period in community houses called *parthenones*. Not till the institution of monasticism did they live according to established rule. Thenceforth they are known as "Nuns" (from the French *nonne*, supposed to be derived from an Egyptian term meaning "virgin"). The nuns of Egypt and Syria cut their hair—a practice not introduced in the West till a later period. In the early Middle Ages there were many communities of nuns in France, Italy, Spain, England, and Ireland, whose organization was, with a few exceptions, similar to that of monks. Heading each community was an "abbess," who, like the abbot of the monasteries, had complete jurisdiction in matters of administration.

A CLUNIAC MONK

The order of Cluniac Benedictines was founded in 910. In place of the manual labor of the Benedictines, this order substituted prolonged church services.

Those who enter a religious community, whether of men or women, must first become "postulants." Then follows a "noviceship," the period of which differs for various communities, but it must not be in any case less than one year. Following the novitiate comes the "profession," which is either simple or solemn. At the solemn profession the religious takes the three vows of poverty, chastity, and obedience. Often the constitutions of an order add other vows inspired by its purpose. Thus the Friars Minor (Franciscans) make a special vow of obedience to the Roman church and the pope; Carmelite sisters and "Discalced" (barefoot) Augustinians, a vow of humility; the Passionists, to promote devotion to the Passion of Our Lord; the Brothers of the Christian Schools, vows of stability and gratuitous education of children; the Little Sisters of the Poor, a vow of hospitality.

For any subject not found in its alphabetical place see information

MARVELS *of the* MONOTYPE *and Its* TYPE-CASTER

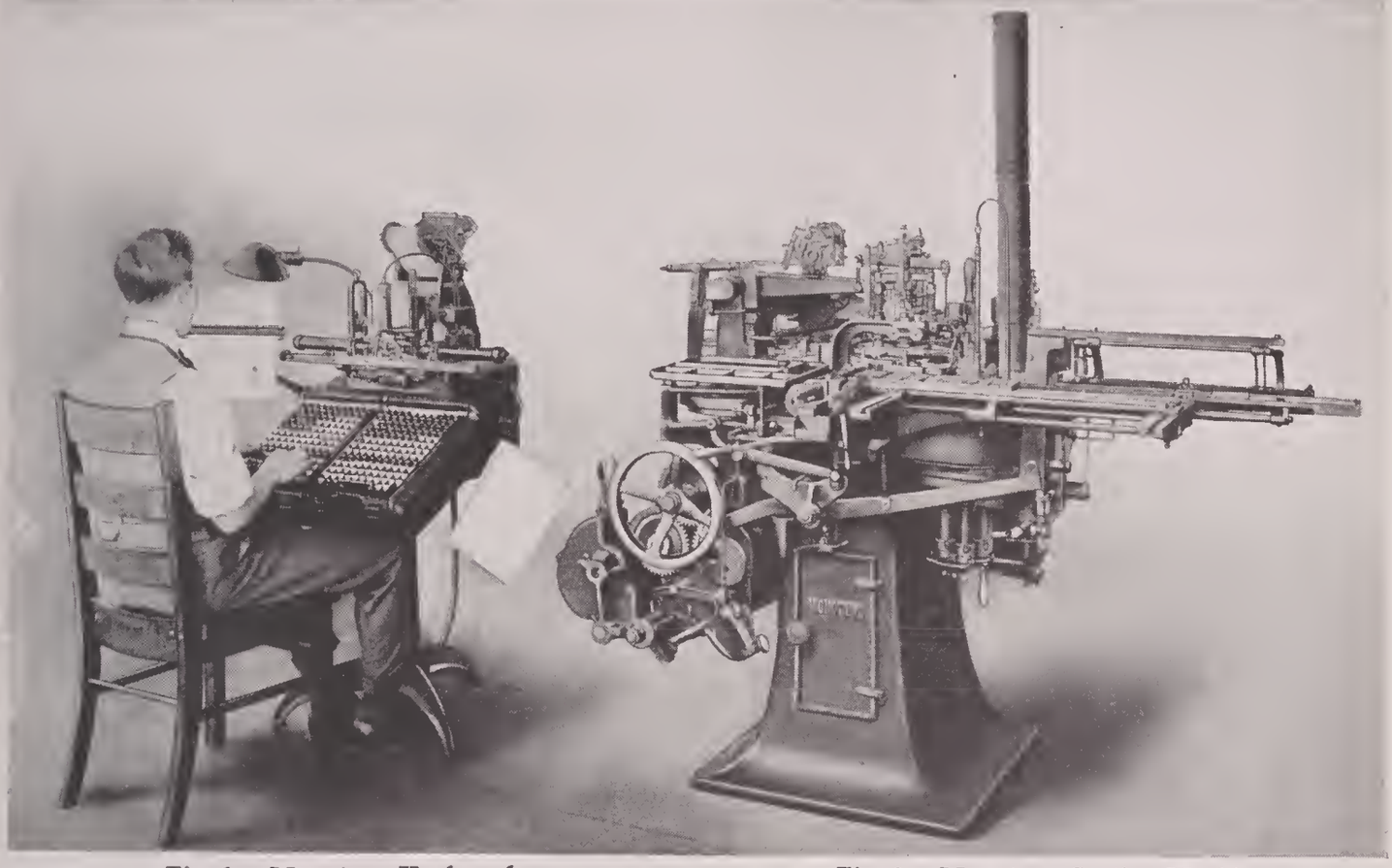


Fig. 1.—Monotype Keyboard

Fig. 2.—Monotype Casting Machine

MONOTYPE. To the patient monk in his "scriptorium," spending years in making a single copy of a book, printing from movable types must have seemed almost a miracle. How stupefied with amazement he would have been if prophetic vision could have shown him the monotype of today which produces thousands of type each hour—cast, set, and "justified" by nimble air-breathing machines operated by simply pressing the buttons on a keyboard.

Strictly speaking, the monotype is *two* machines—a keyboard "composing" machine and an automatic type-caster. At the keyboard of the "composing" machine (Fig. 1) an operator sits and punches a paper ribbon into a pattern of holes. This perforated ribbon, called the "controller paper," is the code of instructions to the caster. When the controller paper is inserted in the caster (Fig. 2), that knowing machine casts one type after another, witn spaces of the proper thickness in order to "justify" each line to the given length; it assembles one line after another and delivers them on galleys the same as though the type had been set by hand—and all with less oversight than it takes to keep a gasoline engine pumping water on the farm. Unlike the linotype, which produces solid bars or "slugs" of metal, each having a line of type characters on its face, the monotype casts each character separately (*see* Linotype).

The monotype keyboard is somewhat like a giant typewriter keyboard. It has more than 260 keys because, while the typewriter carries only two alphabets—one of capitals and one of small letters—the monotype carries five or more different alphabets. With those five alphabets on the keyboard, the operator can make controller papers that enable the caster to produce hundreds of different faces of type of various sizes.

Both keyboard and caster are controlled by compressed air. When you touch a key on the keyboard, a complicated system of valves, pipes, levers, and punches perforates the moving paper ribbon (*see* diagram, Fig. 3). Each key controls a particular combination of perforations, which is made by no other key; each set of perforations made by any key, therefore, stands for the character on that key and for no other, just as each dot-and-dash combination in the Morse telegraph code stands for one particular letter and no other. The monotype code, however, is one of position, like the code of letters and numbers that helps to find places on an indexed map; this you will understand better when we examine the caster.

One interesting feature of the keyboard deserves particular notice. This is the "justifying scale," the swinging cylinder above the keyboard, around which run row on row of figures. Printed matter, you know, must be "justified" or spaced so as to fill out each line and leave no ragged edges. When the operator nears the end of a line, a warning bell rings as it does on a typewriter. The operator looks at his

copy and finds, let us say, that his next word (one of six letters, like "pledge") cannot be divided, and he has not enough space to put it in. What does he do?

Ask rather what the machine does. The operator looks at the justifying scale; the space-pointer on it, which has been keeping tab on every letter, points to figures indicating the spacing that must be used to fill out the line. The operator presses the red spacing keys at the top of the keyboard as the pointer tells him; that is all. The caster, thus instructed by the perforation which this makes in the controller paper, will do the rest.

Fig. 3 shows how the "controller paper" of the monotype receives its perforations. When a key is pressed the valve-bar opens an air valve, and by means of the piston, lever, and punch, one or more holes are made which stand for that letter or character. Those perforations then become the instructions to the automatic caster to cast that type or character. In the picture parts of this wonderful machine are removed in order to make clear the principle on which it operates. For instance, only one of the two keyboards appears, so you can see the inside.

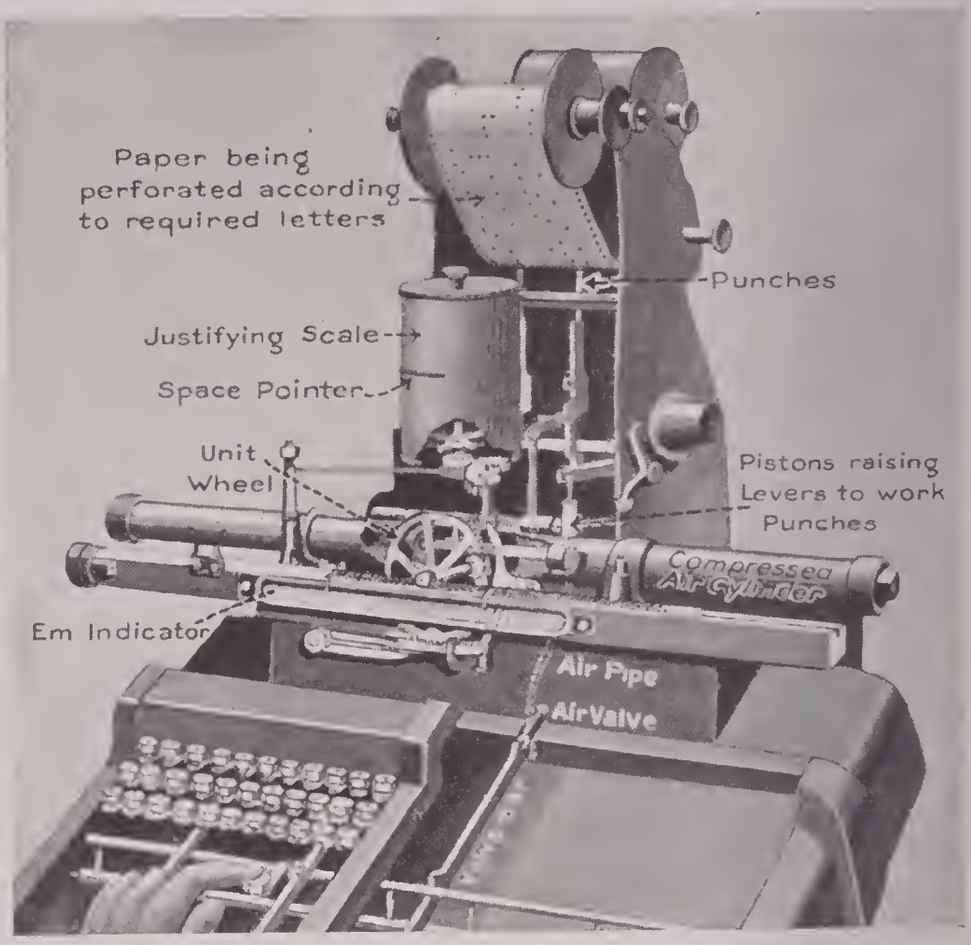


Fig. 3.—How the "Controller Paper" is Perforated

Now let us look at the caster diagram (Fig. 4). It consists essentially of the following parts: (*a*) a pot of molten metals heated electrically or by a gas flame; (*b*) above the melting pot, a mold for a single type into which the molten metal is driven at the right instant by a pump; (*c*) face down over the mold, a matrix case (Fig. 5) in which are locked 225 matrices in which the faces of the type are formed; and (*d*) a compressed air supply, with outlet valves which control the mechanism that does the casting.

When the perforated controller paper is placed in the caster, and the machine is set going, what happens is briefly this. Each set of perforations in the paper, as it comes opposite the row of holes in the air cylinder, releases air into little tubes or pipes, and by a marvelous system of pin-blocks and rods the matrix case is instantly shifted so that the matrix for the corresponding letter or character is brought directly over the type mold. As soon as this is centered over the mold, molten type metal is forced by the pump-plunger into the mold, and the type is cast. Automatically the width of the type-mold alters with the size of the letter to be cast, so that a capital letter M, for example, will

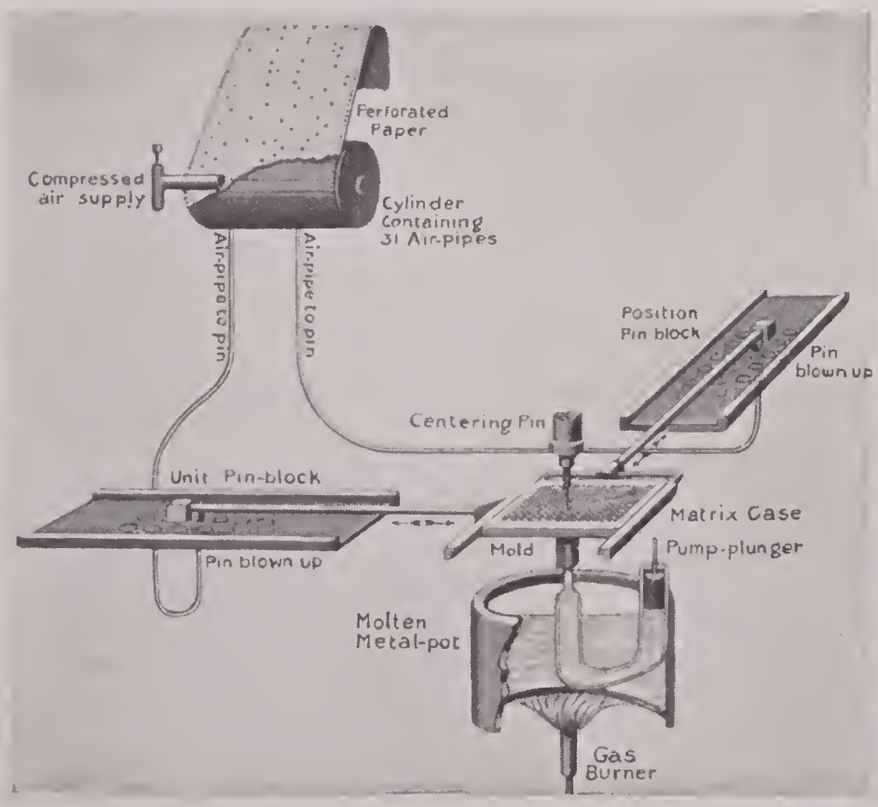


Fig. 4.—How the Monotype Caster Works

have a wider body than an I. The operation of adjustment and casting is repeated as each new combination of perforations passes over the compressed air outlets. By an exceedingly ingenious arrangement the spaces between the words in each line are cast thicker or thinner, as a result of the spacing indications, so that each line of type when completed exactly fills the page or column measure.

Figure 4 shows clearly how the monotype caster performs this marvelously ingenious work, clicking out finished type, perfectly cast and "set" in proper order, faster than one can count. Compressed air is released through the row of holes in the cylinder into a series of air pipes, which connect with the two groups of pin-blocks. By one series the matrix case is moved so many spaces to the left or right; by the other, at the same time, so many spaces forward or back. Thus the case is held in position above the mold to form the letter called for by the perforated instructions on the controller paper. Up wells the molten metal in the mold, impelled by the pump; down bites a centering pin holding the matrix case firmly over the mold just long enough for the liquid metal to solidify—which is not nearly so long as it has taken to say all this. In another instant, the mold opens and out glides the perfect type to be assembled with its predecessors, while the machine goes on at the rate of 150 castings a minute. This diagram shows only two of the air pipes, and of course omits much else in the complicated machine in order that the principle on which it operates may be made clear.

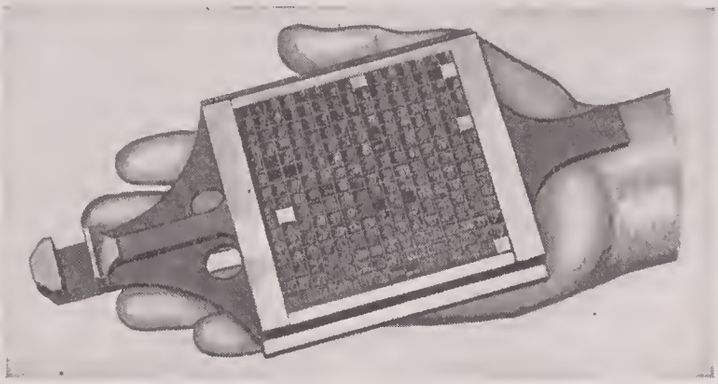


Fig. 5.—Matrix Case

So entirely independent are keyboard and caster of each other that a keyboard in New York or San Francisco may prepare a controller ribbon from which a caster in Chicago or New Orleans may cast and set type—and set it just as well as if the two machines were in the same room. And because the monotype, like the hand compositor, sets movable type, its work may be corrected or altered by hand, letter by letter, instead of having to be reset like linotype work.

This wonderful machine—in many respects more wonderful even than the linotype—was invented and patented in 1887 by Talbert Lanston, for many years a clerk in the Pension Office in Washington, D.C. It is not so well suited to the work of daily newspaper offices as the linotype, but it has a wide field in book, magazine, and general job printing.

The PRESIDENT *Who Said to Europe:* "HANDS OFF!"

How James Monroe, Author of the Famous Monroe Doctrine, Won His Way to the White House—His Lifelong Devotion to Jefferson and His Quarrel with Washington—A Man "Without a Blemish"

MONROE, JAMES (1758–1831). As the president who first announced the principle known as the "Monroe Doctrine," James Monroe, fifth president of the United States, holds an important place in American history. The idea of the doctrine that "America is for the Americans" did not however originate with Monroe. Washington, in the wars between England and France, had publicly warned the nation to "beware of entangling alliances," and Jefferson had privately declared, "The day is not far distant when we may formally require a meridian of partition through the ocean, on the hither side of which no European gun shall ever be fired, nor an American on the other." It was left to Monroe, however, to make this doctrine of "hands off" for Europe a matter of official record by incorporating it in a message to Congress in 1823. (*See* Monroe Doctrine.)

Although the Monroe Doctrine is still part of the United States' foreign policy, the man Monroe is little known, and his other achievements almost forgotten. He was tall, but so inclined to stoop that he looked less than the six feet which were actually his. His features were rugged and his awkwardness and shyness added to the unfavorable impression that he made. He never overcame this appearance of timidity.

Monroe's education was rather deficient. His family, of Scotch and Welsh descent, belonged to the class of small planters of western Virginia, and he had just entered William and Mary College, at the age of 16, when the Revolution broke out. With a number of fellow-students and professors he at once left school to enter the army. Though Washington speaks of him as a brave officer, he failed to secure promotion beyond the rank of lieutenant-colonel, and during much of the time he did not see active service.

In 1780 Monroe left the army and entered upon the study of law under Jefferson, then governor of Virginia. Here began the friendship which lasted until Jefferson's death, and which greatly influenced Monroe's career. In writing to Jefferson he once said, "I feel that whatever I am at present in the opinion of others, or whatever I may be in future, has greatly arisen from your friendship."

Monroe was in turn a member of the Virginia assembly, of the United States Congress under the Articles of Confederation, of the state convention which ratified the Federal Constitution, and of the United State Senate under that constitution. He was successively minister to France, Spain, and England, governor of Virginia for several terms, secretary of state and of war under President Madison, and finally was the fourth Virginian out of the first five presidents to hold the highest office in the American republic.

In the Virginia convention of 1788 Monroe, along with Patrick Henry and Richard Henry Lee, opposed the ratification of the Federal Constitution. He feared lest the United States might become a monarchy and he fought the Constitution until amendments were promised which he thought necessary to safeguard the rights of the people. In the United States Senate, when appointed as one of Virginia's first representatives in that body, he allied himself with Jefferson's party in favor of "strict construction," and opposed Hamilton's measures which were intended to strengthen the national government.

Nevertheless, as his party was friendly to France, Washington sent Monroe as minister to that country in 1794, where he arrived a short time after the fall of Robespierre. Even the excesses of the Reign of Terror did not cool Monroe's ardor for the Revolution. Unfortunately he allowed his partisan feelings to carry him so far as to say in a public address in Paris that the treaty which John Jay, under Washington's direction, had just concluded between the United States and England was "the most shameful transaction I have ever known of the kind." For this and other indiscretions he was recalled in disgrace. When he returned to America he published a justification of his conduct in a pamphlet entitled 'A View of the Conduct of the Executive in the Foreign Affairs of the United States', in which he severely criticized Washington. Though the president took no notice of the pamphlet at the time, it is said that he never forgave Monroe for this unwarranted attack.

JAMES MONROE

MONROE'S ADMINISTRATIONS
1817–1825

"Era of good feeling" (1817–25).
Admission of Mississippi (1817), Illinois (1818), Alabama (1819), Maine (1820), and Missouri (1821).
Seminole Indian war in Florida (1817).
Joint occupation of Oregon country with Great Britain agreed upon (1818).
Florida purchased from Spain (1819).
Financial crisis (1819).
First steamship crosses the Atlantic (1819).
Monroe reëlected (1820).
Missouri compromise over slavery (1820).
Cumberland Road bill vetoed (1822).
Monroe doctrine set forth (1823).
Protective tariff bill passed (1824).
Internal improvements bill passed (1824).
Lafayette re-visits America (1824–25).
John Quincy Adams chosen president by House of Representatives (1824).

In 1803 Monroe went to France a second time, sent by Jefferson as a special minister to aid in the negotiations which led to the purchase of Louisiana. After that memorable purchase was completed he went to Spain to try to buy the Floridas also, but in this negotiation he was unsuccessful. As minister to Great Britain he negotiated a treaty in 1806, but this was rejected by President Jefferson, who refused to lay it before the Senate because it contained no provisions against imprisonment and interference with the rights of neutral ships.

During the War of 1812 Monroe served under President Madison as secretary of state, and also for a time as secretary of war. The city of Washington was burned by the British during the time that Monroe acted as secretary of war but his measures as a whole won him popularity, and his position as secretary of state put him in line for the presidency.

In 1816 Monroe reached the pinnacle of his career when he was elected to succeed Madison as president, with Daniel D. Tompkins of New York as vice-president. Monroe's vote in the electoral college was 183, to 34 cast for Rufus King, the Federalist candidate. Monroe and Tompkins were reëlected almost unanimously in 1820; the one vote cast against him at that time is said to have been "so that no one might share with Washington the honor of a unanimous election."

During Monroe's administrations he still displayed his interest in expanding the territory of the United States. He was successful in purchasing the Floridas from Spain in 1819, and by the successful prosecution of a war against the Seminole Indians he opened up that new region to settlement.

But expansion brought new and troublesome questions with it. If the people occupied an extensive territory, better means of communication were nec-

essary. Monroe was interested in seeing these secured, but as a strict constructionist he believed that Congress did not have the power to provide them. Consequently he vetoed a bill providing for internal improvements. A more important question in regard to the new territory was whether slavery should be allowed in it. The problem was temporarily settled in 1820 by the Missouri Compromise, but it was not finally decided until slavery was abolished at the close of the Civil War. (*See* Missouri Compromise.)

The period from 1817 to 1825, during which Monroe was president, has sometimes been called the "Era of Good Feeling," because there was only a single organized political party during that interval. There were, however, so many personal factions, each of which desired to see its leader president, that the election in 1824 has been called the "scrub race for president." The "Era" was also marked by the second visit of Lafayette to the United States.

With the inauguration of John Quincy Adams in 1825, Monroe retired to private life after a public career covering more than 40 years. During that time he had displayed no wonderful ability as legislator, diplomat, or executive; but he had proved an honest and patriotic citizen, whose motives were never questioned even by his enemies. Jefferson well said of him that "he is a man whose soul might be turned wrong side outwards without discovering a blemish to the world." His closing years were harassed by debt, and he removed from Virginia to find a home with his son-in-law, in New York City, where he died on July 4, 1831.

MONROE DOCTRINE. What is known as the "Monroe Doctrine" is not a part of international law, nor even of the law of the United States; but it has formed the basis of American foreign policy for a hundred years, it has been the cause of much diplomatic correspondence, and the United States has stood ready to fight for it on occasion. Its first formal expression is found in the message of President Monroe to Congress, Dec. 2, 1823. The occasion which called it forth grew out of the revolt of the Latin American colonies from Spain about 1815, and the creation of new republics in Mexico, Central America, and South America. Weakened Spain could not hope to regain her colonies unaided, and there was talk of the alliance of reactionary European powers, which had just put down revolutions in Italy and Spain, interfering forcibly in Latin America with a view to reëstablishing Spanish rule there.

This policy was opposed not only by the United States, but by Great Britain also. Several times the foreign minister of England, George Canning, proposed that the United States join England in a declaration against such intervention. John Quincy Adams, then secretary of state, thought it better that the United States should make an independent declaration; and after discussion with President Monroe, he formulated most of the important presidential message delivered on December 2.

Pointing to the fact that it was America's policy not to intermeddle in European affairs, President Monroe gave warning that any attempt by the autocratic monarchies of Europe "to extend *their system* (of intervention) to any portion of this hemisphere" would be considered by the United States "as dangerous to our peace and safety." He added that we could not view "in any other light than a manifestation of an unfriendly disposition toward the United States"—which was practically a threat of war—the attempt of the autocratic monarchies (Austria, Russia, Prussia, and France) thus to oppress and control the destiny of governments whose independence we had recognized. In a later section of the message the view was expressed that the American continent was no longer open to new colonization. This was aimed at Russia, which was then planning to set up a colony at San Francisco, on Spanish soil. These two declarations are the seed from which has grown the Monroe Doctrine of today. Great Britain gave unqualified support to President Monroe's doctrine, and has never withdrawn it.

The Doctrine Proves Effective

The declaration had the desired result, and no serious European interference in the Americas was attempted until 1861. Then Napoleon III attempted to place Maximilian, an Austrian prince, upon the throne of Mexico. The United States was just entering upon the Civil War, but she immediately voiced her protest to France. As soon as peace was restored in 1865 she concentrated a large force of troops on the Rio Grande frontier and insisted upon the removal of the French army. In 1895 the doctrine was again applied in respect to a boundary disputed between Venezuela and British Guiana, President Cleveland succeeding in inducing Great Britain to arbitrate the matter. At this time Secretary-of-State Olney gave the best brief definition of the Monroe Doctrine when he said that its "single purpose and object" was that "no European power or combination of European powers [should] forcibly deprive an American state of the right and power of self-government and of shaping for itself its own political fortunes and destinies."

In Roosevelt's administration the Monroe Doctrine was used against Germany also, when in 1902 she was prevented by the United States from collecting by force of arms debts due to Germans from Venezuela. President Roosevelt, however, felt that the South American governments should not be allowed to use the Monroe Doctrine as an excuse for repudiating their obligations, and his message to Congress maintained that the United States ought to exercise a sort of police authority over these states. This policy, called the "Big Stick," has been put into practice several times, notably in 1905, when the President appointed a receiver of customs for Santo Domingo and effected its deliverance from debt. It is an extension of the original meaning of the Monroe Doctrine, and one which is strongly resented by other countries of the New World.

The Monroe Doctrine did not mean that the European colonies which existed at the time of its announcement should be abandoned. Nor does it mean that the United States will lend its aid in every case of dispute between an American and a European government since it is not a treaty of alliance. It does not forbid any American country from setting up any kind of government it wants, but applies only when coercion by other nations is attempted.

This great idea underlying the Monroe Doctrine—that nations have a right to determine their own institutions—is still vital today. In 1917 President Wilson said: "I am proposing, as it were, that the nations should with one accord adopt the doctrine of President Monroe as the doctrine of the world: that no nation should seek to extend its policy over any other nation or people, but that every people should be left free to determine its own policy, its own way of development, unhindered, unthreatened, unafraid, the little along with the great and powerful."

MONTAIGNE (*mŏn-tān'*), MICHEL EYQUEM DE (1533–1592). This famous French essayist seems more nearly to be "all things to all men" than almost any other French writer. People of every nation, people of every sort of disposition and belief, have read his essays for the past 300 years, more and more of them every year. Therefore we may be assured that he did not take sides heatedly about most matters, nor create any new and set way of writing which might please some and not others. His essays flow along as clearly and naturally as water, and are as widely refreshing, always whimsical, full of the amusing twists of Montaigne's mind. He found himself very funny. He would write, in these essays which people still like so well, of his own clumsiness, of how he could not harness a horse or carve a roast or fold a letter, and what a task he found it to tell lettuce from cabbage in his garden. Those are things about which all the world may smile, but not argue. Many a time he states ideas much more complicated and serious than his troubles with harnesses or cabbages, but always with suavity, openness to another's ideas, musing gentleness—sometimes even with a sly and cynical smile. But he attracts all men to fish for themselves, in silence, from the lovely waters of his great stream of essays, and nobody wrangles about Montaigne, any more than they would shout beside a trout stream.

Montaigne's training and life were extraordinary, and we perceive him, always dressed in plain black, as a lonely, rather bitter, eccentric, and even crotchety figure. Yet he could mourn half his life for his one great friend, Étienne de la Boetie; and in his eye occasionally flamed a light such as that which shamed and drove away a scoundrel and crowd of ruffians who had marched into his house to plunder it.

When Montaigne was a baby he was nursed by a poor woman in a village, as his father wanted him to feel sympathy for the poor. And we ourselves may still feel sympathy for the poor of this same village, who were all obliged to learn Latin that they might always speak that tongue to the little Montaigne, and thus make it easy for the child to learn a language which was considered the foundation of education! The boy was also awakened always to the sound of music. Is it strange that he grew up to be a highly trained, refined, and singular man?

He loved solitude, and had a tower built on his house, where he worked, and where he even had a little chapel and heard mass all alone. Not even his wife was allowed in his tower. Indeed, Montaigne had no very high opinion of the intelligence of women. And a mocking Fate so arranged it that his six children were all girls, and it was a young woman admirer, Marie le Jars de Gournay, to whom he confided his last literary ideas, and who therefore became editor of his essays after his death, revising them in accordance with notations which he left. The first two books of his essays appeared in 1580 and the third in 1588.

MONTANA, STATE *of* TREASURE *and* OPPORTUNITY

MONTANA. Texas and California are the only states of the Union larger than Montana, which has an area nearly three times as great as the state of New York. The mountains and forests in its western part would almost cover Ohio; the farm lands of its plains and valleys are almost equal in size to Minnesota; and Delaware and Maryland could be placed upon the vast grazing fields in the east. The beautiful Glacier Park in the northwest, one of the most interesting of national reservations, is in itself larger than the state of Rhode Island (*see* Glacier National Park).

Extent.—North to south, about 300 miles; east to west, 550 miles. Area, 147,182 square miles. Population (1920 census), 548,889.

Physical Features.—Rolling plains in east (elevation, 2,000 to 5,000 feet); Rocky Mountains (highest point, Granite Peak, 12,834 feet) in west; chief ranges, Bitter Root (western border), Lewis, Big Belt, Little Belt, Absaroka Mountains. Principal rivers: Missouri and its tributaries, the Yellowstone, Musselshell, and Milk, in the east; Clark Fork of the Columbia and its tributaries, the Missoula and the Flathead, in the west. Flathead Lake; Glacier National Park.

Products.—Copper, silver, zinc, coal; wheat, hay, oats, potatoes, flaxseed, apples; cattle, sheep and wool; lumber and timber products; flour, meat, and other food products; copper wire, cables, railroad cars, etc.

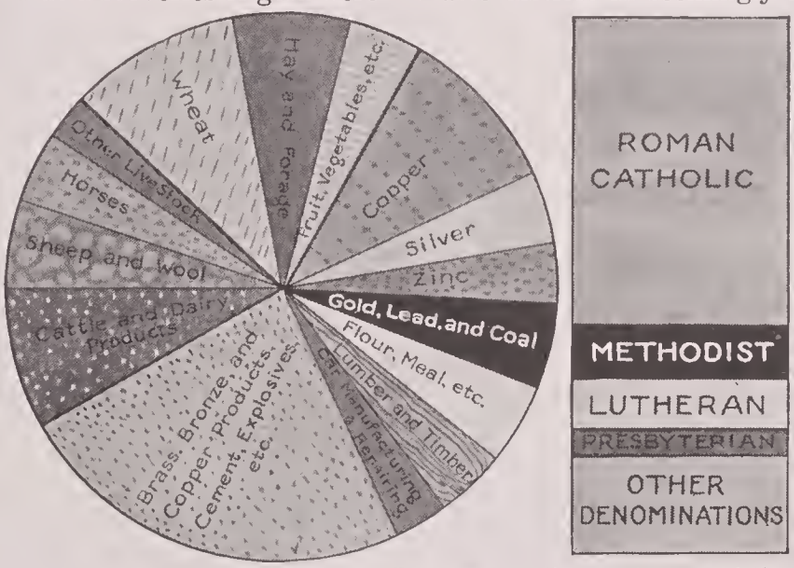
Principal Cities.—Butte (42,000), Great Falls (25,000), Billings, Missoula, Helena (capital), Anaconda.

The name "Montana"—from a Spanish word meaning "mountainous"—clearly describes a large part of the state. If we could stand upon the summit of one of the lofty peaks and look about us, we should see at first nothing but a riot of rocky pinnacles shooting out of interminable forests; then out of the chaos would come stretches of grassy plains, a glint here and there of a shining lake, and dark canyons cut by roaring cataracts. This is part of the great roof of the continent, from which waters are carried to three oceans—the Arctic, Pacific, and Atlantic.

MINING, AGRICULTURE, STOCK RAISING—ALL PROSPER HERE

In the mountainous western part Montana is a vast treasure house of minerals—silver, copper, and coal. The rolling foothills of the eastern half support famous stock-ranges and rich farms. Metals and metal manufactures comprise nearly half of the total value of the state's yearly products. Wheat leads in farm products, followed by cattle and dairy products, sheep, wool, and horses.

It is not impossible that a group of men traveling through Montana in 1850 might have failed to see a single other white man. But discoveries of gold were made during the next 12 years, and those made after 1860 attracted thousands of eager prospectors into the state; cities grew up in a few weeks, and the first era of Montana's prosperity was begun. Helena sprang into being with the discovery of "Last Chance Gulch" in 1864, and many other mines of great richness gave rise to other towns. Silver - lead ores were next developed. In a few years, however, gold and silver production began to decrease rapidly, and many of the old town sites were abandoned. Then, not far from Butte, a straggling village which had once been a prosperous silver camp, a great discovery was made. In 1882 Marcus Daly, a shrewd miner, in sinking a great shaft at Anaconda, discovered a rich copper ledge, and his success gave rise to an industry which has since led all others in Montana. Ore was found at other places in the Butte district in seemingly inexhaustible quantities, and Butte became the greatest copper-mining camp in the world. Hundreds of miles of tunnels honeycomb the ground beneath it, making a subterranean city where men work day and night, endlessly pouring forth the earth's treasure; while in the city above, vast plants for smelting and refining copper give work to many men. Today most of the metal mined in the state comes from the Butte region, and Montana ranks high among the states in copper production. The world's largest copper-smelting works are at Anaconda.



Here we see the relative value of Montana's leading products, and the comparative numerical strength of the religious denominations.

Silver is still produced in large quantities, chiefly as a by-product of copper, to which it ranks second in value. Zinc is another leading mineral. Though one of the richest coal states in the West, Montana

"OCEANS" OF SHEEP ON MONTANA'S ROLLING HILLS

Years ago Montana was the land of the cowboy, and great herds of cattle, trailed from the far southwest, roamed its hills, growing fat upon the abundant grass. Today much of the old "open range" has been turned over to sheep. Vast flocks guarded by "herders" —in the West they are never called "shepherds"—have to a great extent dispossessed the "long horns," for cattle will not graze where sheep have been pastured.

ranks as yet below several other states in production, but the output of the mines is steadily increasing. Montana leads all the states in the production of precious stones, chiefly sapphires. Other products are lead, oil, and natural gas. The state is also rich in building stone and marble.

Products of Farm and Orchard

Practically every variety of farm product grown in a temperate climate can be raised in Montana. Wheat is the leading crop, but all grains do well, and hay is valuable and important. Montana is one of the chief producers of flaxseed. Potatoes and sugar beets thrive, and all kinds of garden vegetables are grown successfully. The beautiful and fertile valleys of the Bitter Root, Flathead, Yellowstone, and other rivers are famous for the quality of their fruit. The apple is the principal fruit raised, and there is no more juicy or fragrant apple than the Mackintosh Red, which is like the snow apple of boyhood days, only the orchardist has given it a "college education." Big black cherries are another product of Montana's soil, sunshine, and irrigation. Except in the Flathead valley, in the western part of the state, agriculture was long considered to be dependent upon irrigation, but "dry farming" has recently been found to be successful and is much used in eastern Montana. Many valleys have been made to blossom with water brought down from the mountains. Much of the land is irrigated by private and coöperative enterprises, but seven large projects under supervision of the United States government are under way, and almost as many under state control. Although only a small proportion of the land is under cultivation, the total value of farm products in some years surpasses the total value of mineral products. The great forests of Douglas fir, pine, and other soft woods which cover the mountain sides yield a considerable output of lumber.

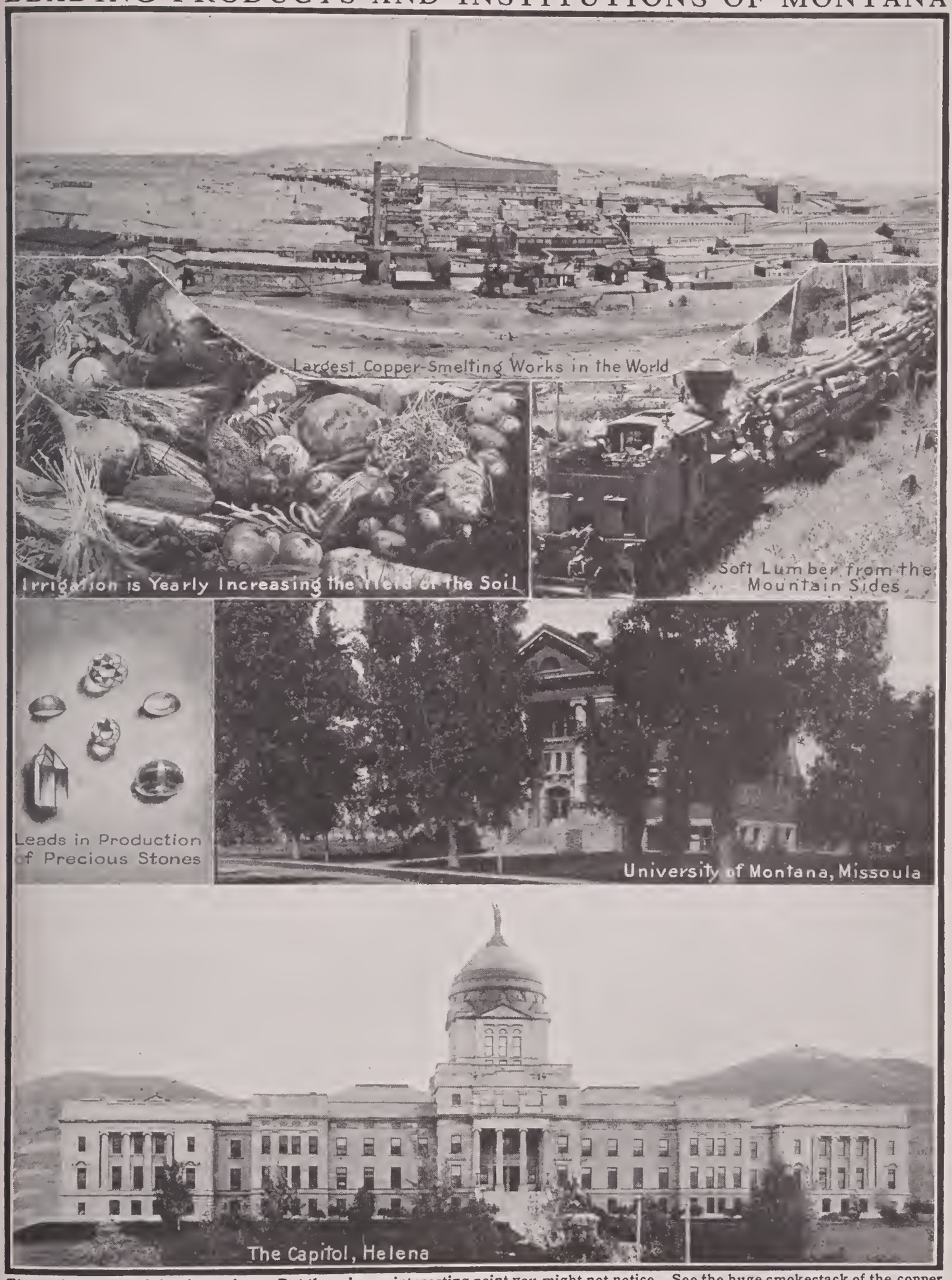
The sight of vast herds of wild animals roaming over the great eastern plains and fattening on the rich buffalo and bunch grass of the semi-arid country pointed out to the early settlers a means of acquiring wealth more certain than mining, and cattle-raising soon became a great industry. Although the increase of farming has to some extent encroached upon their pastures, countless thousands of cattle, sheep, and horses still graze upon the prairie and valley lands. Montana ranks among the six leading states in the number of its sheep and the production of wool.

The vast potential hydroelectric power of its many streams and rivers promises some day to make Montana an important manufacturing state. The chief industry is copper smelting and the manufacture of copper products. The manufacture of phosphate fertilizer has recently been developed to make use of the surplus sulphuric acid which is a by-product of the smelters. Lumber and timber products, flour, beet sugar, and packed meats are among the most important of the lesser industries.

Great Variety of Climate

Owing to its great size and varying altitudes—from 2,000 feet above sea level in the extreme east to 4,000 or 5,000 at the foot of the Rocky Mountains and more than 12,000 feet at the summits—Montana has an extremely diversified climate. In the west it is generally delightful, being greatly affected by the warm winds which blow from the Pacific Ocean; but in the east the winters are long and cold, and the summers dry and hot. There is little or no rain except in spring and early summer. Owing to the absence of high humidity, the climate is very healthful. The story is told of a Montana real estate agent who was boasting to a "tenderfoot" of the climate when they suddenly came in sight of a little cemetery. "How is that?" said the prospective buyer. "I thought you

LEADING PRODUCTS AND INSTITUTIONS OF MONTANA



These pictures speak for themselves. But there is one interesting point you might not notice. See the huge smokestack of the copper smelter rising high up on that hill, far removed from the works? Well, you must know that smelter fumes are poisonous to vegetation and bad for human beings. The stack is situated in that way so the smoke will spread out and become diluted with air before it reaches the ground and so do as little damage as possible.

contained in the Easy Reference Fact-Index at the end of this work

said no one ever died out here." "Oh," said the land boomer, "that is the family of a fool doctor who moved in here and his family starved to death."

By far the largest of Montana's cities is Butte. In the daytime it seems like a great mining camp set down in a modern city, but at night with its lights shining from all the hillsides it seems a bit of wonderland. Here is located the State School of Mines. Helena, the capital, is a city of beautiful homes, picturesquely situated amid the Rocky Mountains, with splendid roads leading from it in all directions to scenic points. It is the seat of the Montana Wesleyan College. The country about it is rich in both mineral and agricultural resources, with productive coal fields and lumber mills.

Great Falls, the second city in the state, derives its commercial importance from the power furnished by several falls of the Missouri River. Billings, the largest city in the eastern part of the state, is a railroad and distributing center for a rich agricultural and grazing region.

Missoula, the "Garden City," is the seat of the state university, which, with the State College of Agriculture and Mechanic Arts at Bozeman, the State School of Mines at Butte, and the State Normal College at Dillon, makes up the University of Montana. It is in a farming and fruit-growing, lumbering, and mining section, and controls a considerable trade in grain and fruit. Situated where three valleys come together, Missoula is sure of two things—picturesque views and a breeze. It contains large lumber mills and railroad shops, a beet-sugar factory, flour mills, and other industries.

Anaconda, 26 miles from Butte, has, like that city, developed with the copper industry. It is noted for its copper-smelting works. Deposits of gold, silver, lead, and sapphires are also found in the vicinity, and railroad and machine shops, foundries, and brick works are among its industries.

It was not until after the United States had acquired Montana in 1803 as a part of the Louisiana Purchase that an authentic account of it was obtained. Lewis and Clark with their band of followers explored the country in 1804–05, and were among the first white men to set foot within its borders (*see* Lewis and Clark Expedition). For more than 50 years thereafter few people save trappers and Indian traders visited the territory, which remained a vast and almost unknown wilderness until the discovery of gold in the 1860's. In 1864 Montana was organized as a separate territory and in 1889 was admitted to the Union. In 1876 Gen. George Armstrong Custer, with his command of 600 United States cavalrymen, met a tragic end on the Little Big Horn, being massacred to the last man by the 6,000 Sioux warriors who had risen in rebellion under Sitting Bull.

The present population is a cosmopolitan mixture from almost every state in the Union and Canada. A disappearing element are the early settlers from Missouri and the border states who came about the beginning of the Civil War. There are in the state about 11,000 Indians, chiefly located on four reservations covering about 10,000 square miles.

Montcalm, Marquis Louis Joseph de (1712–1759). The name of Montcalm, the commander of the French troops in Canada during the French and Indian War, is inseparably linked with that of Wolfe, the British commander, as they were the two principal actors in that most spectacular drama which decided that North America was to be chiefly English-speaking and not French, and that it was the self-governing institutions of England that were to prevail and not the absolutism of France under the Old Régime. Though Montcalm suffered defeat and death in the conflict, his name stands as high in the opinion of posterity as does that of Wolfe, his conqueror. In Quebec today there stands a monument to the two heroes, bearing this inscription in Latin: "Valor gave them a common death, history a common fame, and posterity a common monument."

Montcalm had entered the army of France at the age of 14, and risen to the rank of colonel by the time he was 24. Ten years later he was sent to America, with the rank of brigadier-general, to command the French troops in that theater of the world-wide war with the British. He won victories at Oswego, Fort William Henry, and Ticonderoga. But at Quebec Wolfe proved himself the better general, and the French were defeated on the Plains of Abraham, west of the city. Montcalm, as well as Wolfe, was mortally wounded during the battle; when told that he could not live, he replied: "Thank God! I shall not live to see the surrender of Quebec."

Monte Carlo (*mŏn'tĕ kär'lō*), Monaco. The gleaming white walls and tiled roofs of the famous Casino or gambling hall at Monte Carlo seem almost part and parcel of the creamy chalk rock of the little triangular Mediterranean promontory near where France and Italy meet. Men and exquisitely gowned women from every quarter of the globe, royalty, the extravagantly rich, the venturesome, the "born gamblers" of the world, gather here each night, after dining at one of the several sumptuous hotels within a stone's throw of this famous gaming palace. Crowded about tables, little and big, playing *les petits chevaux* or faro or *écarté* or *baccarat*, or any one of a dozen card games, each player is as intent upon his game as if it were a life and death matter. And sometimes it is nearly that. Great fortunes have been made and lost here, and despair and death have followed a spin of the gambling wheel. The only sound that breaks the almost breathless silence is the *croupier's* signal, "*Faites vos jeux, messieurs!*" ("Make your plays, gentlemen!") or perhaps an unexpected exclamation from one of the ring of onlookers.

The Casino with its wide terrace fronting the sea is the center of the life of the little city behind it, with its long street of Parisian shops and gay little tea rooms. Monte Carlo and two other towns, all melting into one another, cover practically all of the terri-

tory of the independent principality of Monaco, ruled by the Prince of Monaco. His tiny realm, dotted with lovely gardens and magnificent villas, occupies the very fringe of the foot of the Alps and two promontories—only about eight square miles in total area. The gambling privileges yield so large a revenue that no taxes are paid by the people of the principality. None of the prince's subjects are allowed to play at the gambling tables.

OVERLOOKING THE BLUE MEDITERRANEAN

Because of its world-famous Casino, most strangers think of Monte Carlo only as a gambling resort. But it is also one of the most charming winter resort regions in the world. This view of the promenade adjoining the Casino gives a hint of its charm.

The town of Monaco, within its ancient battlemented walls and bastions, is reached by a tramway or by climbing long flights of steps through winding streets. It centers about the palace of the Prince of Monaco, near which stands the cathedral and a remarkably fine museum of ocean wonders surrounded by interesting gardens. From here one has a charming view along the coast. To the west lies Nice, nine miles away; to the east, across the Bay of Monaco past Cap Martin is the frontier of Italy. The population of Monte Carlo is nearly 10,000; of the principality of Monaco, about 23,000.

MONTENE'GRO. As the smallest independent kingdom in Europe, and the only portion of the Balkan peninsula which was never really subjected by the Turk, Montenegro long possessed a romantic interest aside from that given it by its picturesque mountains and its sturdy bright-costumed people. The country lies on the eastern shore of the Adriatic, just north of Albania, and the name means "Black Mountains." Until the Balkan War of 1913, which nearly doubled its area at Turkey's expense, Montenegro was only three-fourths the size of Connecticut.

In 1914 Montenegro came to the aid of Serbia when the latter was attacked by Austria, and as a result was overrun by the Austro-German armies. It was freed in 1918. Following the close of hostilities the national assembly voted for union with Serbia in a new Jugo-Slav state (*see* Jugo-Slavia). King Nicholas resisted this deposition, but in vain, until his death in March 1921.

The people, who number about half a million, are of the Slavic race and belong mainly to the Greek Catholic church. They cultivate small farms and herd their flocks on their mountain pastures. They have a rich literature of patriotic songs and ballads, the outgrowth of centuries of Turkish warfare. The capital is Cettinje, some miles inland from the Dalmatian coast.

MONTESSO'RI METHOD. Many parents and teachers have felt that there was not something, but many things, radically wrong with the training which the traditional school gives. With all allowance for the zeal of the advocates of new systems, some weight must be attached to this feeling. The little lad or girl starts to school at five or six years of age, full of curiosity, eager to know what school is. Often in a short time the youngster has learned to hate his studies, his school, and the teacher. What is the cause? What is the remedy?

Dr. Maria Montessori (1870–), an Italian physician in Rome, became convinced that she had discovered both the cause and the remedy. Her suc-

TRAINING THE SENSES OF TEMPERATURE AND FORM

At the left a little girl has been given a pitcher of water to pour into a bowl. When the water is poured out, she will put her hand in it and will learn to tell whether it is cold, warm, or tepid. This trains the "sense of temperature." At the right a little boy is fitting wooden squares, triangles, and circles into their proper frames and so developing his "sense of form." The other little boy at the table is fitting round, square, and triangular pegs into holes—another way of teaching the same lesson.

cess in teaching mental defectives convinced her that the remedy for many of the evils in the ordinary schoolroom was to be found in the principles she had followed in teaching backward and defective children.

On Jan. 6, 1907, Dr. Montessori opened a school for normal children between three and seven years of age, in a tenement house in one of the poorer districts of Rome. To get away from the idea of a school in the ordinary sense, she christened it "Casa dei Bambini," that is, "House of the Children," or "House of Childhood." Within a few years Dr. Montessori's system had awakened world-wide interest, and Montessori teachers and schools were to be found in America, England, France, Russia, and the Orient.

The first Montessori school in the United States was opened in 1911 in Tarrytown, N. Y., by Miss Anne E. George, Dr. Montessori's first American pupil, and the translator of her book on method. In 1912 Miss George went to Washington and opened a school in the house of Mrs. Alexander Graham Bell. The parents of the children attending this school organized the Montessori Educational Association, to extend the system throughout the United States. Madam Montessori has since visited the United States, and her own account of her method is to be found in her book, 'The Montessori Method', translated by Miss George. Montessori schools are now found in practically every state in the Union.

HE TRAINS HIMSELF

Under the Montessori system children are trained by exercises which seem like play to them.

The most important things which distinguish a Montessori school from the ordinary school are: (1) The unusual effort to care for the child's health; (2) its provision for sense training; (3) its unique methods of teaching reading and writing; (4) its emphasis upon liberty in all phases of school work, particularly in matters of discipline; (5) lessons in self-help and home-help.

The Montessori system requires that a physician be attached to each school, just as a physician is attached to the home. He is to come at the teacher's call, and one of the first things a Montessori teacher does when a child seems listless, indifferent, or naughty, is to send for the school physician. Besides this, the physical and sanitary conditions of each home are inspected by the school authorities.

Our senses are the gates to our knowledge. It is through our eyes, ears, hands, and finger-tips that we learn to know the world in which we live. Instead of beginning education with the alphabet and books, the Montessori system offers the child sets of objects known as "teaching material." The purpose of these sets is to train the child's senses.

The sense of temperature (thermic sense) is trained by putting the child's hands into water—cold, warm, and tepid. Later, he arranges in pairs a set of bowls, each two of which contain water of the same temperature. He selects the pairs by feeling the bowls.

"LESSONS" IN A MONTESSORI SCHOOL

This looks more like playing on the lawn at home than going to school, doesn't it? That is the central idea in the Montessori system, making lessons seem like play, and the schoolroom a place where youngsters like to be. Games, blocks, and drawings are used to train the children's senses and judgment, and the more "bookish" things are taught with this preliminary work as a foundation. And throughout it all the children can talk and move about, instead of having to sit still at desks.

The thermic sense exercises stimulate the sense of touch as well. The first object specifically devised to train touch is a small oblong board. The back is varnished. Half the face is covered with fine sand paper. The other half is bare and unvarnished. By passing his fingertips lightly over the different parts of this board the child comes to distinguish three gradations of touch sensation—rough, smooth, and very smooth. Later he will be given cloths of varying degrees of smoothness, and a set of flat, thin, wooden tablets—a circle, a rectangle, a triangle, and others set in a solid wooden background. The child pulls the insets out of their frame. The teacher leads him to pass his fingers lightly around the edges. Thus, through his sense of touch, combined with a motor sensation, he gets a mental image of the inset. With these mental images as a guide, he now tries to put the insets back in place.

If the child tries to put the circle in the triangular frame, it of course will not fit. The teacher makes no suggestions. She lets him struggle until he discovers his own mistake and corrects it by getting the circle into its place and the triangle into its. This principle of the child teaching himself, or *self-education*, is carried out as far as possible in every phase of the Montessori system.

Many sets of materials other than those described above are provided to train the senses of temperature, vision, hearing, weight, and form.

Children four years old in the Montessori school learned to write in a month and a half, and after two and a half months were able to write any word dictated to them. At five they wrote excellent hands in ink. Learning to write precedes learning to read and begins with the small letters. A detailed account of the methods used cannot be presented here. The most important thing is not the rapidity with which nor the early age at which the children acquire these arts, but rather the fact that they learn without any consciousness of performing a task, and indeed regard it as fun.

A stranger going into a Montessori school for the first time is likely to be shocked by the noise and commotion. Children run, walk, call to each other or sing to themselves as they choose. What conception of discipline allows such a hubbub? The fundamental principle of Montessori discipline is liberty. The child or adult who continually represses himself and obeys rules because he is afraid is a suppressed, not a disciplined, individual. The only sound basis of self-control, and therefore of discipline, is liberty. The Montessori system recognizes that there are limitations to personal liberty. These are summed up in the term "good breeding," which means a consideration for the rights and happiness of others. Moreover, the teacher must see that useless or dangerous actions are suppressed.

This principle of liberty is carried as far as possible into every phase of education. The primary purpose of the first exercise in any activity is to determine whether or not the child has reached a stage of development which fits him for profiting by it. Children are never compelled to learn anything in which they

show no interest, nor to keep at a task after they have grown tired of it. Again, what and how much the children are to eat is not prescribed by the teacher. At luncheon the food is passed and each child helps himself, taking as much or as little as he chooses, and selecting the things he likes best.

The individual who desires liberty must be independent of the help of others. A very little child may make important beginnings in this process. The long school day in the Montessori school (9 a. m. to 4 p. m.) gives an opportunity for teaching many lessons in self-help. In the Montessori school, children between three and four are taught to button and unbutton, to tie and untie bows, to fasten and unfasten hooks, to set and wait on table, to carry out dishes, to dust, to make change.

Good and Bad Features of the Method

The following features of the system are generally commended: (1) The unprecedented emphasis upon the child's health; (2) no forcing; (3) discipline through liberty if not carried too far; (4) social training and lessons in responsibility; (5) relation of teacher to child; (6) learning from environment.

The following criticisms have been made against the Montessori system: (1) The teaching materials are below the intellectual level of normal children between three and seven; (2) no sufficient provision is made for the child's imagination, rhythmic, aesthetic, and play instincts; (3) sense training should be gained in connection with experiences vital to the child and not through isolated exercises with meaningless objects; (4) the conception of the mind upon which the system is based, namely, the "faculty conception," is declared to be antiquated and erroneous; (5) in the most fundamental field of all, the intellectual, the child is allowed no liberty; he is required to use his didactic materials according to the preconceived ideas of the system.

Partly as a result of these criticisms and partly as a result of further experimentation, the Montessori advocates have been obliged to modify somewhat their claims, and the method, so far as it is adopted, will undoubtedly be modified to meet varying American conditions.

MONTEVID'EO, URUGUAY. From nearly every point in the handsome and splendidly situated capital of Uruguay one has a view of either the vast turbid stream of the Rio de la Plata—here 60 miles wide—or of the land-locked Bay of Montevideo. For the city is built partly on a whaleback-shaped promontory that thrusts west from the coast, and partly on low hills along the shores. The streets rise one above the other like a series of terraces, affording a perfect natural drainage and making the city one of the most healthful in the world. Since 1908, when a channel 24½ feet deep was dredged and long breakwaters built, all but the largest of ocean steamers have been able to enter the harbor. Before this they had to anchor far out in the river and load and unload by means of small boats or lighters.

From any direction the view of this "City of Roses" is a lovely one. Flowers are everywhere, in private gardens and public parks; and along the curve of the bay are beautiful suburban residences. Many of the houses are of three stories, built of a stone quarried near by, and are in architecture much like the buildings of Europe. There are many imposing public buildings—banks, theaters, government buildings, normal schools, a military college, and a university. The streets are wide and laid out at right angles, as in the cities of the United States.

The principal industries are connected with cattle raising. There are several meat-drying and salting establishments in the city, in some of which one may see acres of posts strung with wire from which is hung meat being dried in the sun—the "jerked beef" which is the only cheap form of beef that can be kept any length of time in warm countries. Near the city is an establishment for preparing frozen meat, where thousands of cattle and sheep from the enormous Uruguayan ranches are killed every day. Other important establishments are dairies, creameries, and tanneries—outgrowths of the cattle industry.

Across the bay from the city is the conical hill from which it takes its name. Though it is not so high as the Washington monument, it is the highest point for miles around. Population, about 362,000.

MONTFORT, SIMON DE (1200?–1265). "I fear thunder and lightning exceedingly," King Henry III of England once said to Simon de Montfort, "but I fear thee more than all the thunder and lightning in the world." And well might the inefficient king fear his powerful brother-in-law, who was leading the barons of England in their concerted opposition to Henry's misgovernment.

Simon de Montfort, a stern and warlike knight, was a Frenchman by birth who had become Earl of Leicester in England. At first the English barons distrusted him because of his foreign birth. On the other hand, although he had married the King's sister, he was frequently out of favor with Henry. When the King sent him to govern Gascony, or Aquitaine, one of England's possessions in France, he blamed Simon for violent and severe rule because of the complaints of rebellious lords.

It was after the earl had given up this task and returned to England that he became the leader of those who wished to end the king's misgovernment. When the barons saw that Henry did not intend to keep his promises to reform, they resorted to arms. "Though all men quit me," declared Simon de Montfort, "I, with my four sons, will remain and fight for the good cause which I have sworn to defend, and for the honor of the Holy Church and the welfare of the kingdom." In the first battle, fought at Lewes in the southern part of England, the barons were not only victorious but they also took captive King Henry and his son Edward.

While Simon de Montfort exercised power he made a change in the Great Council or Parliament for

which he will always be remembered. In calling a meeting in 1265 he summoned not only the barons and rulers of the church, who had always attended, but also two knights from each shire and two townsmen from each of those cities and boroughs (towns) which could be depended upon to support his reforms. This is usually called the first Parliament, because it was the first in which the "Commons" (as opposed to the clergy and nobility) were represented.

Soon after this meeting Prince Edward escaped from captivity and rallied about him many of the nobles who were dissatisfied with Earl Simon's harshness. He showed much skill in forcing Simon to fight in an unfavorable position at Evesham in the west of England on Aug. 4, 1265. When the earl saw Edward's army approaching in great numbers and excellent order he said: "They come on skilfully, yet it is from me that they have learned this order of battle. God have mercy on our souls, for our bodies are Prince Edward's."

True to his prediction Simon and his barons were defeated though they fought bravely. The earl himself was slain, but the reforms which he had begun were continued by the wise Prince Edward. The people of England lamented the fall of "St. Simon," as they came to call the earl, and a song is preserved which they made soon after his death:

On Evesham's plain is Montfort slain,
Well skilled our war to guide;
Where streams his gore, shall all deplore
Fair England's flower and pride.

Month. The word "month" comes from *mona*, the Anglo-Saxon word for moon, and its length was from one new moon to the next. This is called a lunar month (from the Latin *luna*, moon). It is usually reckoned as 28 days, but the actual mean duration is 29 days, 12 hours, 44 minutes, and 2.7 seconds. The lunar month is sometimes called a "synodic" month.

A "solar" month is one-twelfth of the time taken by the earth for its revolution around the sun. "Calendar" months differ in length, as is indicated in the old rhyme, of which one version runs—

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Save February alone,
Which has twenty-eight days clear
And twenty-nine in each leap year.

In computing interest 30 days is usually taken as a month.

Montreal (*mŏn-trē-äl'*), Quebec. On May 17, 1642, a little band of French colonists landed on the island where the St. Lawrence and Ottawa rivers meet. Mass was celebrated by the light of fireflies imprisoned in a bottle. Thus was planted, in the words of a priest who accompanied the expedition, "a grain of mustard seed that shall rise and grow till its branches overshadow the earth." For this was the beginning of the city of Montreal, the commercial and financial heart of Canada, where nearly one-third of the Dominion's total trade is centered.

Although nearly 1,000 miles from the Atlantic Ocean, the city is reached by ocean-going steamers, and a system of canals and railroads connects it with the Great Lakes and the interior of the Dominion. On account of its location at the break in transportation caused by the Lachine Rapids, Montreal has become the largest and most important city of Canada and one of the greatest seaports of America. It ranks next to New York and New Orleans in grain shipments and has a great number of diversified industries, including meat packing, and the manufacture of boots and shoes, railroad cars and locomotives, paper, clothing, lumber products, structural steel, and industrial machinery.

Montreal is a city of contrasts, and one of the most beautiful places on the continent. It is built on the southeast side of the island of Montreal, which is 30 miles long and from 7 to 10 miles wide. Behind it Mount Royal (from which the city takes its name) slopes up to a majestic height and the view from the top is one of the finest in America. About three-fourths of its inhabitants are of French descent, but three-quarters of the trade and business is in the hands of the British. The French, however, dominate the political life of the city. It has been customary for the mayors to be British and French alternately. Many of the population speak both French and English and the council proceedings and other records are kept in both languages.

A multitude of churches, many of them of great beauty and artistic merit, are scattered over the city. Here is the church of Notre Dame, built after the style of the famous Notre Dame in Paris; the new church of St. James, modeled after St. Peter's at Rome, and the Christ Church Cathedral, famed as one of the most perfect churches in Canada. Beside Notre Dame stands the seminary of St. Sulpice, a relic of the days of French rule and the earliest school in Montreal. Chief among the many educational institutions are McGill University and L'Université de Montreal. As elsewhere in the province of Quebec there are two systems of public schools, one for Roman Catholics and the other for Protestants. Population, about 800,000.

Moody, Dwight Lyman (1837–1899). At 17, the boy who was to become one of the most noted of American evangelists was a clerk in a Boston shoe store. Two years later he went to Chicago and became active in religious work, hunting up ragged children in the worst parts of the city and forming them into a Sunday-school class, which grew into a great mission. During the Civil War he also worked among the soldiers. Moody's great work was as an evangelist, but his many converts in Chicago founded a church, and made him their pastor. This charge did not keep him from carrying on many great revivals in other cities. With Ira D. Sankey, the singer (who died in 1908), he several times visited England. Much of his later life was given to building up the Moody Bible Institute in Chicago.

The EARTH'S CHILD, RULER *of the* TIDES

MOON. The Moon is one of the smallest of the heavenly objects, but because it is relatively near to us it looks to be the largest, next to the Sun, and we know more about it than of any of the planets or stars. With a telescope we can actually see its mountains and ravines, its craters and broad expanses or plains, which early observers thought were seas. We know the geography of that part of the Moon which we can see nearly as well as we know the geography of the earth, and all the principal mountain ranges and craters and "seas" have been named. Among the ranges are those called the Caucasus, the Apennines, the Alps, and the Carpathians, some of whose peaks rise as high as 20,000 feet; among the craters are Apollonius, Archimedes, Julius Caesar, and Tycho, and among the "seas" are Mare Serenitatis (the "Serene Sea"), Mare Imbrium (the "Rainy Sea"), Oceanus Procellarum ("Hurricane Ocean"), Lacus Mortis ("Lake of Death"), and so on.

This diagram shows how much of the Earth the Moon would cover if it were placed immediately over the United States.

But such names are purely fanciful. There are no seas because there is no water, or very little, and there are no storms such as ours because there is practically no air or atmosphere. Indeed we might almost say that nothing ever happens on the Moon. There are no winds to stir the dust or waters to moisten it. No cloud ever moves in the airless sky or flash of fire comes from an erupting peak. The land is cold and dark, and over all broods a terrible emptiness.

HOW LACK OF ATMOSPHERE AFFECTS SCENERY

This picture shows how a sea-side scene would appear, if the Earth lacked atmosphere, like the Moon. Without air there would be no diffusion of light, and the sky would appear as though it were night, save for the blazing reflection of the Sun on the surface of land and water.

With nothing to breathe and probably nothing to eat or drink, human life or any form of animal life could not exist on the Moon. Even if it could, life would not be very pleasant there from our standpoint. The lunar day—that is, the time from sunrise to sunrise—is about a month long. Two weeks of blinding, scorching sunlight are followed by two weeks of frigid arctic darkness. During the period of sunshine the temperature may go up to boiling, but during the long lunar night it probably goes down to 200 and even 400 degrees below zero.

In ages past the Moon was doubtless the scene of violent "moonquakes" and volcanic eruptions. Whether the volcanoes caused the craters, some of which are 100 miles in diameter, is not known; they may possibly be the result of collisions with huge meteorites. In any event it is supposed that the Moon is now a dead planet.

The area of the Moon (14,685,000 square miles) is a little less than the combined areas of North and South America. Its diameter (2,160 miles) is about one-fourth that of the earth, and it would require 49 moons to equal the Earth in volume and 81 to equal it in weight (or mass). The Moon's average distance from the earth is about 239,000 miles, whereas the Sun is 400 times as far away. It would take an airplane traveling 150 miles an hour somewhat more than two months to reach the Moon.

The moon is the Earth's only satellite. It revolves around the Earth because it is held in leash by the force of gravity exerted by the superior mass of the Earth. But the Moon itself reacts on the Earth, causing tides (*see* Tide).

The phases of the Moon—"new," "half," and "full"—result naturally from its various positions with respect to the Sun and Earth. Deriving all of its light from the Sun, the Moon is "new" when it is between the Earth and the Sun; it is "full" when it is on the side of the Earth away from the Sun. Solar eclipses occur only when the Moon is new, and lunar eclipses when the Moon is full (*see* Eclipse).

THE BARREN LANDSCAPE OF THE MOON

This striking photograph was taken with the 100-inch reflector at Mt. Wilson. The picture shows the moon in natural position, and not upside down, as it would be seen through a telescope. The smooth area in the center is the Mare Imbrium (Rainy Sea), bounded below at the right by the Apennines. The shallowest and most prominent of the three craters at the right near the mountains is Archimedes. Directly above Archimedes, on the margin of Mare Imbrium, is the black, ring-like plain known as the crater Plato. If you look closely in the lower left-hand corner you can make out the dimly outlined crater Copernicus, one of the hugest of all. It is 46 miles across and is rimmed in by mountains 12,000 feet high. The smaller crater to the right and above Copernicus is Bullialdus.

contained in the Easy Reference Fact-Index at the end of this work

The Vast and Shining Solitudes of the Moon

THE mind of man can hardly conceive that life has ever been upon the Moon, but as we look at this silent world and see with our own eyes the mighty record of its past, we feel a sense of the boundless mystery of the universe. We stand on a world of life and look on a world of death. We see spread out before us, in the full light of the Sun, a landscape as vast as the American continent, with not a living thing upon it. Not a flower blooms, not a tree grows, not an insect creeps. Not a sound is heard, not a thing moving; the silence of a thousand ages is unbroken in this solitude that no man knows.

"HIGH JUMPING" ON THE MOON

You could certainly set a world's record for high jumping on the Moon. Gravity only pulls one-sixth as hard there as it does on the Earth. Therefore, if you can jump six feet in an athletic contest here, your lunar leap would be 36 feet.

But it was not always thus. The energies let loose in the World War were like children's toys compared with the explosive forces that must once have rent and torn the Moon. Forces incalculable and unthinkable have made her what she is—beautiful to look upon as she rides in majesty with the Earth around the Sun, but with a face all scarred and worn with time, and the mark of some great agony written over it. Who is not moved by that picture of the Moon which Prof. J. A. Thomson has given us? We may say of the Moon, in his words, that "it was Earth's only child, and it died!"

Several different theories have been advanced as to the origin and history of the Earth-Moon system. One of the most interesting of these was advanced by Prof. George H. Darwin, who sought to show that the Moon and the Earth were originally one mass and that they have come to their present state through the influence of the tidal action of each on the other. According to this theory the Earth, it is said, was once shaped like a pear, and as it spun around the small end of the pear broke off and spun around independently. For ages and ages it went around the Sun side by side with the Earth; but slowly it got farther away, until at last it is where it is, as far away from us as ten times around the world. This happened, it is said, millions of years ago, when the Earth was cooling down from its molten state and a crust about 30 miles thick had been formed; and the part which broke away equaled about 5,000 million cubic miles of matter. More recent investigations, however, have tended to show that, fascinating though this theory is, in all probability it does not accurately represent the past history of the Earth and the Moon.

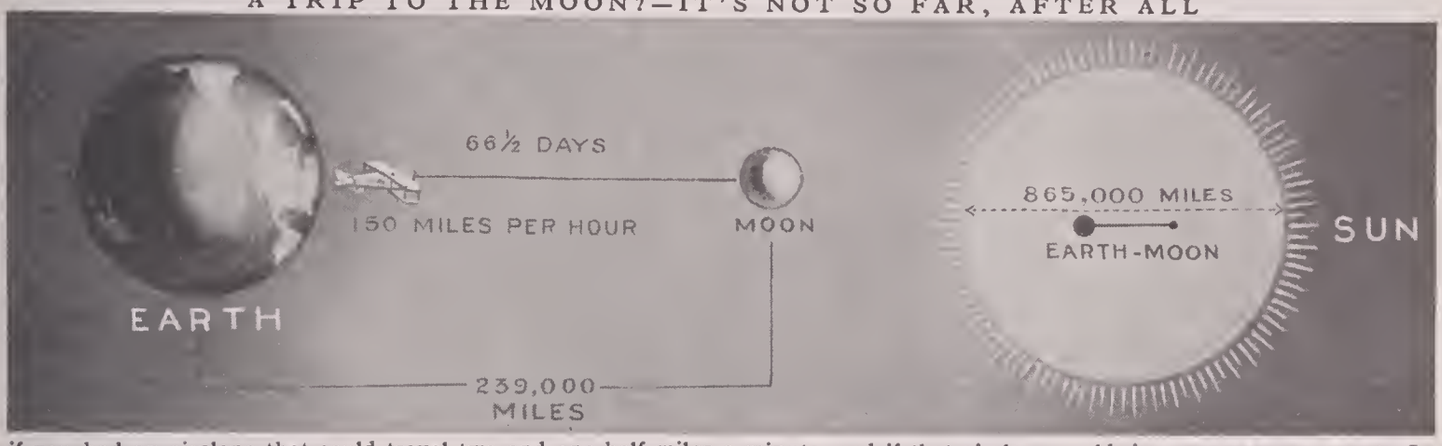
A more recent theory, and one with no outstanding facts against it, teaches that the Moon was formed by the drawing together of a great number of small masses about a larger one which attracted the smaller ones by reason of its greater mass. These small masses were probably of the same sort of material as those from which the Earth and other planets were built up. In all probability the Earth and the Moon were formed in the same way, at the same time, and of material which came originally from the Sun as the result of some cosmic explosion (*see* Planets).

What has been the life of the Moon since then can never be fully known. So far as we know, no man has seen the whole Moon at any time, and whether life has ever been upon it no book can say. Certainly there was no life of any kind when the Moon was formed. Its mighty mass of red-hot matter was cooling down and there was not a living thing on either Earth or Moon.

The pull of the Earth on the Moon and the pull of the Moon on the Earth have never failed; and today they travel together and revolve together, so that the

other side of the Moon has never yet been seen by anyone on Earth. But we know, from the face that we see, that the Moon has had an amazing history since it was first formed. The Sun pours down its light and heat on it unceasingly through a day 300 hours long. No life like ours could exist in the heat that reaches the side turned to the Sun; but on the opposite side the Moon is always as cold as ice, and no life like ours could endure a cold like that. A man living on the Moon would spend his long day in the tropics and his long night in the Arctic. He would have to endure alternately such heat and cold as human beings have never known.

A TRIP TO THE MOON?—IT'S NOT SO FAR, AFTER ALL



if you had an airplane that could travel two and one-half miles a minute, and if that airplane could, in some way, manage to fly across empty space, it would take you more than two months to reach the Moon. Perhaps this distance makes you gasp! But this is nothing compared to the next point in this picture. The diameter of the Sun is more than twice the distance between the Earth and the Moon. If the Earth were at the center of the Sun, the Moon could revolve around it, and still remain inside the Sun.

A World without an Atmosphere

No atmosphere envelopes the Moon, so the fierce heat of the Sun pours down on it unchecked. There is no blanket to break its heat, no ocean of air to diminish its intensity or soften its dazzling light. And as there is no atmosphere, there is no "sky light," so that the Sun shines on the Moon from a dense black sky. It would look like a great white ball shining in pitch black night. When the Sun withdraws its light and the Moon is wrapped in night, the darkness there must be as in the darkness of a pit. A day and a night on the Moon are equal to a month on earth, so that for 14 of our days a man of the Moon will live in light and heat unknown to us, and for another 14 days in blackness and cold such as Earth never experiences.

We can hardly think of a world like that as anything but dead, and if the Moon was born when the Earth was born we may ask why it has died so soon.

Why is Earth still covered with green trees, and carpeted with flowers, and throbbing with the life of a myriad living things, while the Moon is dead and bare? It is because the Moon is smaller. If the Earth were small like the Moon, our air would gradually be left behind as the Earth traveled through space. With the air would go our water; and with air and water gone, no life would be possible on Earth. We would have the same great heat of the lunar moon and the same extreme cold of the lunar night.

On the Moon, all life and water and air have passed away, all sound has gone. No speech is possible; the men on the Moon, if such there be, are deaf and dumb; for sound depends on air, and the Moon has none—or if there should be any at all, it must be twice as thin as what we call a vacuum!

Weird and strange indeed are the scenes on this dead world, and it is one of the triumphs of the human mind that we know them well. Long before we knew the North Pole of the Earth men knew the North Pole of the Moon. Men find their way about the Moon as easily as about the Grand Canyon of the Colorado or parts of Africa. It was the first thing man began to study in the heavens. If it filled men with dread in ancient time, it gave them their first ideas of anything beyond this world and their first glimmering of the outer universe. The shepherds of Chaldea would sit and look at it, and think it a sort of mirror in which the image of the Earth reflected back; and after Calvary, men saw the figure of Judas in the Moon, suffering transportation for his treason. Long after that, wise men, looking at the Moon through telescopes, imagined that the marks they saw were made by man, as some men think today of the marks on Mars. Old Kepler used to think that these huge crater-walls upon the Moon were built by man; they looked to him like the walls of pits built as shelters from the long fierce action of the Sun.

But Kepler did not know the nature of the things he saw—their vastness and their age. It is these craters that seize a man's imagination. They are the handwriting on the Moon. They are gigantic beyond anything seen on Earth, and the forces that made them are beyond our understanding. There are hundreds of them, and from some of them vast quantities of matter have been flung for more than 20 miles. Their walls rise up miles high and some of them are so wide that two men standing one on each side would be as far apart as if one were at the Atlantic end and the other at the Pacific end of the Panama Canal. The walls rise sheer like walls of houses, but they fall away outside, and for a hundred miles at times we can trace the vast extent of those tremendous forces which flung up burning lava in molten streams from the

furnace of the Moon. These craters, according to one theory, are the remnants of volcanoes, but to what can we compare the mighty cataclysms which tore the very heart of the Moon to pieces and left it yawning with chasms and stricken with death?

The Moon is only one-sixty-fourth the volume of the Earth and one-eighty-first of its mass, and gravity there has only one-sixth of its force on Earth. Explosive forces on the Moon, therefore, would be six times as effective as on Earth. Everything on the Moon is six times lighter—a brick that weighs six pounds here would weigh one pound there; a man who can jump six feet here would jump 36 feet there; a gun that fires ten miles here would fire 60 miles there.

We can imagine, therefore, that these internal forces that seem almost to have torn the surface of the Moon to bits must have been beyond all human experience or conception. In parts the surface of the Moon is strewn thick with craters; and rising from the floor of these we find enormous cones, standing like obelisks, sometimes a mile high, and sometimes with another crater in the cone, formed, we may suppose, by the last expiring efforts of the eruption that built up the great circular walls. Some craters have cracks across that are quite a mile wide, and one great crater, more than 50 miles across, is filled to the brim with lava, as if it had oozed out after the walls had been formed until it filled the huge round pit with a mass of solid rock.

BRINGING THE MOON HOME TO US

Here is a skilled model-maker, patiently carving a model of the Moon out of a plaster-of-Paris sphere. The instrument is a drill resembling the one a dentist uses, and the man carves each crater and mountain with infinite care, using photographs taken with telescopes as his guide. You can see some that have been carved and several marks on untouched parts indicating where others are to go. When the carving is done the "Moon" must be painted.

Those Frightful Blow Holes in the Moon

It is believed that sometimes, in these explosions on the Moon, a single eruption may have sent forth, crashing out of the red-hot depths, hundreds of cubic miles of matter. In some craters there are gaps across the surface a mile wide and 150 miles long, and deeper than from the top of our highest mountain to the bottom of our deepest sea.

And, as chasms are deeper and craters wider, so mountains are higher on the Moon. A grain of mustard seed on a globe three feet across would represent the highest mountain on the Earth, but a grain of seed on a globe one foot wide would stand for the highest mountain on the Moon.

Cliffs on the Moon are much steeper than on Earth, and the mountain scenery, if we could see it as we see the Rocky Mountains or the Alps, would be far grander than our own. One mountain chain has 3,000 mountains packed together; the lunar range we call the Alps has 700 glorious peaks, with an immense valley 80 miles long and 5 miles wide that seems to have been cut with a knife.

Amazing are those white pathways that seem to creep wherever we look in the Moon. From one great crater we can trace them for 1,000 miles. One is said to be 1,700 miles long, and they are sometimes 25 miles wide. They go over mountains and plains, over craters and through valleys, straight on and on everywhere, marching like the little Earth creatures called lemmings in those vast migrations which lead them in a straight line to the sea. Somebody has said that if a brush had been drawn across the face of the Moon in a thousand directions the effect would be to give us these white streaks, and they are among the mysteries of the lunar world. They are probably outflowings of lava through the great cracks around volcanoes, but the minds of astronomers are as much puzzled by them as by those enormous areas on the Moon which look like seas. They are not seas, for there is no water on the Moon. But perhaps these great smooth surfaces—though what seems to us as

smooth water is broken in ridges and cracks extending for miles—may be due to the falling of the thin crust into the molten bed below, so that what we see may be the surface of a molten lake turned solid.

Such a world of stillness and mystery and death is this vast and shining solitude of the Moon. We have called it "Earth's dead child"; but we know that nothing can die and cease to be, and Earth's dead child has its glorious immortality.

If the Moon is dead it keeps life sweet on Earth. Perhaps you have not thought of it, but as the Sun keeps our atmosphere in constant circulation through the winds, so the Moon does with the waters. It saves the oceans from stagnation. It is the greatest sanitary agent that any man knows, Nature's beneficent agent for us all. The power of gravitation runs from Moon to Earth and Earth to Moon, and the pull of the Moon on the sea brings the tides up on the shore twice a day. They cleanse the seashore as nothing else could, and carry off the deposits of rivers which otherwise would bring us plague and pestilence.

Aside from causing the tides, the moon undoubtedly tends to slow down the Earth in its rotation. Just how fast the tidal friction will work to lengthen the day is hard to say but it is certain that it will not be more than one second of time in half a million years, so we may lift up our hearts; it will not hurt us. There are good times coming long before the Moon has slowed us down to any considerable extent, and who shall say that the Moon may not have a service still to render to the Earth beyond all our imagination? She may help us with our labor; she may release men from the present burdens of toil.

How the Moon Helps Start Big Cities

Not so very long ago the traffic in our harbors lay at the mercy of the Moon. Our ships sailed up our rivers with the tides, and in the race between wind and tide, the tide would always win. Who will write a book to prove that the Moon put our great cities where they are? It is probably true, for had there been no Moon there would have been no tides and had there been no tides, who would have built New York and Philadelphia where they are?

But let us keep to our story, and think of that boy who, though he knew it not, set out to fight the Moon and win the fight. He was little James Watt, whose aunt would bully him gently for sitting wasting his time watching the steam puff out of the kettle-lid. "You lazy boy, James Watt!" she would say. "Have you nothing better to do than to sit for hours looking at that kettle?" But James Watt was fighting the Moon, and he was winning. He brought steam power into the modern world, and Richard Trevithick and George Stephenson and Robert Fulton, and all the rest of those great pioneers of steam, were fighters of the Moon, although they knew it not.

For steam power makes our ships independent of the tide and more powerful than the wind, and no longer need our sailors await the Moon's convenience.

Well, we have won our independence of the Moon, and now we have to harness her. Millions of tons of water are lifted twice a day for many feet, and we let this mighty power run to waste. It would do the work of half the nation if we made it turn a wheel.

A hundred years ago at London Bridge the rising waters as the tide came in, the rushing river as the tide went out, were made to work pumps that carried water to London people. This power of the tides was one of the good things of the past that men stopped instead of building up. The time may come when we shall build it up again, and then all men who toil will bless the Moon, for it will be the slave of Earth chained to our factories, turning wheels, driving our machines. It may all come "with time and tide," as the poet says.

MOORS. When the Arab armies swept across northern Africa in the 7th century, they found in the northwestern corner of the continent a white race of ancient origin called the Berbers. These they converted to Mohammedanism after a sharp struggle at the beginning of the 8th century. Then Berbers and Arabs joined in invading and conquering Spain, and a mixed race sprang up called the Moors.

The name Moor comes from the Latin *Mauri*, the name for the Berber inhabitants of the old Roman province of Mauretania, now Morocco. It is applied today chiefly to the people of mixed blood inhabiting the seacoast of the Barbary States. The typical Moors of Morocco are a handsome race, with olive skin, black eyes, and black silky hair. The women are beautiful in early youth, but grow fat rapidly, a quality much admired by their own people. The Moors are courteous and intellectual, but also cruel and revengeful. Of all the pirates who infested the Barbary coast in former days, none was more feared than these mild-mannered cut-throats.

The Moors reached the height of their power in Spain. After the conquest of the Visigoth kingdom in 711, and a period of great disorder, the famous Arab Califate of Cordova was formed which lasted until 1031. Following the collapse of the califate, the Moors (Berber-Arabs) who had obtained control of northwestern Africa crossed to Spain and wrested the power from the pure-blood Arabs.

After the battle of Navas de Tolosa in 1212, in which Alphonso VIII of Castile broke the Moorish power in central Spain, the Moors still ruled the kingdom of Granada, which rose to a splendor rivaling the former Califate of Cordova. It was not until 1492 that the power of this Moorish kingdom, weakened by internal discord, was shattered by the armies of Ferdinand and Isabella.

The Moors were then expelled from Spain, to the great economic and intellectual loss of that kingdom. A number adopted Christianity and remained in Spain. About 60,000 of their descendants, called Moriscos, dwell in Spain today. Many remains of the days of Moorish greatness are still found in Spain, chief of which is the Alhambra palace at Granada. (*See also* Arabia; Mohammed; Morocco; Spain.)

THE MONARCH OF THE NORTHERN WOODS

Here he stands, an Alaskan Bull Moose, the most powerful wild animal of North America. When he's in a hurry, he simply pushes his way through the underbrush, overthrowing any small trees which stand in his way. He fears no forest foes, for he is a match for anything except the huntsman's rifle, and is a fierce and courageous fighter. Specimens such as the one shown attain weights as great as 1,400 pounds, and boast antlers measuring six feet from tip to tip. Moose are found chiefly in Maine, Minnesota, northern Michigan, and Canada.

For any subject not found in its alphabetical place see information

Moose. The largest living deer common to the northern regions of the Old and the New World is the elk or moose—for the latter is merely the American counterpart of the European elk. In the Old World the elk is now scarcely found except in the northern parts of Russia and Scandinavia. In the New World the moose is found mostly in northern Maine, Minnesota, and British North America. It has long legs, standing about six feet high, and a large head with broad muzzle and large nostrils. The average weight is about 700 pounds, while unusually large specimens attain a weight of from 1,100 to 1,400 pounds.

The moose can easily be distinguished from all other deer by the magnificent horns or antlers of the male, which sometimes attain a spread of more than six feet. Each antler is like a broad hand, with the palm curved and held upward, and with the margins set with prongs. An average full-grown pair of antlers, with the skull, weighs 70 pounds. They grow gradually, the first year being only knobs an inch high, the second year they grow to about a foot in length, and the third year they take on their palm-shaped character. The fully formed horns are shed in December, sprout again in April, reaching their full size in June. It is remarkable to think of these enormous horns being shed annually and produced again in so short a time.

The moose feeds on willow-tips, on the slender shoots of the striped maple, and other trees, and on bark and various evergreens. It often wades in water up to its neck, to escape flies and mosquitoes and to feed on succulent water-plants. When enraged a bull moose strikes vicious blows with its front feet as well as with the heavy antlers, and is a dangerous foe for man or beast. Moose are rapid runners, and have sharp senses of hearing and smell; as a result they are difficult to hunt. In winter they herd in small troops for protection.

In America the wapiti is often wrongly called "the American elk." In Europe remains are found of an extinct deer, with branching antlers 10 feet across, which is usually called the giant "Irish elk."

More, Sir Thomas (1478–1535). "I say no harm, I think no harm; but I wish everybody good," once declared Sir Thomas More, the great English statesman, scholar, and author. This was no idle boast, for the man who made it was a lovable merry man, with warm affections and a kind heart. Among his children he was a loving companion, and often he would take scholars and statesmen into his garden to see his girls' rabbits. And yet this kindly genial man wished it engraved on his monument that as lord chancellor he was "the scourge of thieves, murderers, and heretics." Surely it would be hard to find a character which blends into harmony so many apparent contradictions as Sir Thomas More's.

Son of a prominent London barrister, young Thomas More was reared as a page in the household of Cardinal Morton, who prophesied greatness for his ward. As a student at Oxford, More came under the influence of the New Learning, and later formed a close friendship with the great Dutch scholar, Erasmus, who was captivated by his charming personality. These two, with John Colet, the distinguished dean of St. Paul's, were the leaders of a group of scholars and religious reformers in England since known as the "Oxford Reformers," who did much to promote the Renaissance in England (*see* Renaissance).

Entering his father's profession of law, More early attained distinction; but for a time religious piety led him to fast, pray, and scourge himself as a preliminary to entering the priesthood. He finally gave up this plan, but the religious motive remained supreme in his life, and every Friday he scourged his body as penance for sin.

His Dispute with the Throne

In 1504 More gained the enmity of Henry VII by opposing, as a member of Parliament, the King's exhorbitant demands for money aids. The accession of Henry VIII brought More, almost against his will, into high place at court. The young king was attracted by the rising lawyer's learning, wit, and geniality, and employed him on various embassies. He knighted him, promoted him through various official posts, and on Cardinal Wolsey's fall from power, in 1529, More was made chancellor—the first time that the office had been held by a layman. More, like Erasmus, wished for an orderly reform of acknowledged abuses in the church, but he did not hesitate to burn as heretics persons who were infected with Protestant heresies from Germany. When it appeared that Henry had resolved on a divorce from his queen, Catherine of Aragon, More as a loyal churchman resigned his office on the plea of ill health. He refused to acknowledge Henry's claim to be head of the English church, and for this defiance the King had More—together with Bishop Fisher and others—committed to the Tower on a charge of treason. Against the pleadings of his favorite daughter, Margaret Roper, his wife, and his friends, More stood firm, and on July 6, 1535, he was beheaded on Tower Hill.

His Courage on the Scaffold

Even in his death More's wit did not desert him. Climbing the scaffold where he was to die, he said to the officer in charge: "I pray you see me safe up; as for my coming down, let me shift for myself." When the ax was about to fall he asked the executioner to wait a minute until he had removed his beard, observing, "Pity that should be cut, which has never committed treason."

More's fame is not merely as a statesman and religious martyr, but as the author of 'Utopia', a romance written in Latin in 1516, and translated into English in 1551. 'Utopia' (which means "nowhere") is the name of an imaginary island which More represents as the abode of a happy society, free from all cares, anxieties, and miseries. All men are equal, and everyone may worship as he chooses. None is allowed to become rich through the oppression of others; property is held in common, and all are

SIR THOMAS MORE IN THE TOWER OF LONDON

Here are Sir Thomas and his daughter, gazing out the window upon four monks being led to execution, during the stormy times when Henry VIII broke with the church of Rome. Sir Thomas, formerly chancellor of the kingdom, had been imprisoned charged with treason when he opposed Henry's move. His family urged him to acknowledge Henry's supremacy, but he stood fast, and eventually died upon the scaffold. On the occasion which this picture illustrates, he characterized the monks as "blessed fathers who were going as cheerfully to their deaths as bridegrooms to their marriage," and it was in this spirit that he met his own fate.

required to perform the same amount of labor. The book had a political object, for the evils which it depicts as remedied in Utopia are those which then bitterly afflicted England. From the title of this book we get the adjective "utopian," which is applied to plans for the improvement of society that are considered visionary and impracticable.

MORMONS. The believers in the 'Book of Mormon' call themselves Latter-Day Saints, though the term Mormon is not particularly offensive to them. They constitute a religious community whose belief is founded upon revelations said to have been made to Joseph Smith in Manchester, N.Y.

Joseph Smith was born in 1805 in Vermont. He was 15 when he had his first vision—his call, as he considered it, to the work of a prophet. This was followed in 1823 by a revelation of the place where he would find the metallic plates on which were engraven the history and religion of the ancient inhabitants of America. In 1827 he dug up this record, he said, together with two transparent stones fastened to the rim of a bow somewhat resembling a pair of spectacles, but larger. This peculiar instrument was called the Urim and Thummim or Interpreters, by means of which he translated the unknown language of the record. Three persons swore to seeing the original record and Interpreters in a miraculous manner, while eight testified that Smith showed them the book of plates. When the translation, dictated by Smith from behind a curtain to amanuenses, had been completed, the plates were removed by the angel Moroni, who had directed Smith to them. Such is the story of the origin of the 'Book of Mormon', the first edition of which was published in 1830 at Palmyra, N.Y.

The name Mormon is that of a prophet who was commissioned to abridge the history of his people, a race said to have come from Jerusalem to America about 600 B.C., which abridgment constitutes the 'Book of Mormon'. It is considered by the Mormons to be of equal authority with the Bible.

The Mormon church was organized in Fayette, N.Y., April 6, 1830, with six members. Converts soon were numerous, and branches were founded in New England, Ohio, and Pennsylvania. In 1831 they formed a colony in Missouri, at Independence, Jackson County, the site of their future capital, to be known as the City of Zion. They were persecuted and driven out of both Independence and a later settlement in upper Missouri. Their relations with their "gentile" neighbors were scarcely less than civil war and the militia was called out at one time. In 1838 the entire membership of 15,000 fled into Illinois where they were kindly received, and in 1839–40 founded the city of Nauvoo; but in a few years the popular dislike broke out afresh, and the prophet and his brother Hyrum, while in prison under a charge of treason against the state, were murdered

by a mob on the 27th of June, 1844. The Nauvoo municipal charter was revoked in January 1845, and the Mormons had to leave the state.

Brigham Young (1801-1877), president of the Twelve Apostles, came to the leadership, and with a thousand families left Nauvoo in February 1845. They wintered in Iowa and Nebraska, and in the spring of 1847 Young with a band of 147 set out for the Rocky Mountains. This region was not then under the United States. On July 24, 1847, the little band came over the mountains looking down upon the magnificent valley south of the Great Salt Lake. Young declared at once that this should be their home. He chose the site for the temple, and Salt Lake City was laid out largely according to his plans Later the "state of Deseret" was set up, but the United States government did not recognize it and in 1850 organized Utah as a territory. The Mormons were pioneers in developing modern irrigation methods, and also set up the first newspaper west of the Missouri.

The Mormons now have many settlements in Idaho, Colorado, New Mexico, and Arizona, besides Utah, and colonies in Mexico and British America. There are also numerous branches of their church in northern Europe, in many of the states of the American Union, and in the Pacific islands. They number upwards of 400,000 members, the great body of whom are in Utah. Their church is officered as follows: A president, who is supreme, and two councilors, the three forming the First Presidency, then a Patriarch, then the Twelve Apostles, of whom the president is one. Below these is a complicated system of priests, "seventies," etc. All these make up the Melchisedek Priesthood. The Aaronic or Lesser Priesthood of bishops, priests, deacons, teachers, etc., has to do chiefly with the worldly affairs of the church, e.g., a Mormon bishop is essentially a business man.

Since their removal to Utah the chief opposition to them has been due to their doctrine of plurality of wives. For years this doctrine prevented the admission of Utah as a state. In September 1890, however, Wilford Woodruff, then president of the church, issued his famous manifesto discontinuing plural marriages; and in 1896 Utah was admitted into the Union (*see* Utah).

MORNING-GLORY. The dainty pink-and-white bell-shaped wild morning-glory may be seen almost everywhere in summer, climbing over stone walls and winding and twisting its way among the wayside shrubbery. Its round leafy stem grows from three to ten feet in length, winding itself tightly about its supports; because of this characteristic it is sometimes called the "great bindweed." At sundown the morning-glory closes its petals, but with the first peep of dawn it again opens its blossoms to the world. On moonlight nights it remains wide awake, hospitably offering shelter to certain moths. The wild morning-glory ranges from Nova Scotia to North Carolina and west as far as Utah; and blooms as late as September.

The cultivated morning-glory which grows about our verandas and in our gardens often reaches 12 feet in height, and if not kept within bounds its twining stems will overrun and choke the more valuable plants in the garden. Its flowers, which range from violet and red to pure white, are larger than those of its wild cousin.

Scientific name of wild morning-glory, *Convolvulus sepium*. Flowers solitary, white or light pink with white stripes, bell-shaped, about 2 inches long, and twisted in the bud, on long peduncles from leaf axis; calyx of 5 sepals, hidden by 2 large bracts; corolla 5-lobed, with 5 stamens inserted; style with 2 oblong stigmas; stem smooth or hairy, 3 to 10 feet long, twining or trailing; leaves arrow-shaped, 2 to 5 inches long, on slender petioles.

MOROC'CO. During the opening years of the 20th century, the Mohammedan country of Morocco, in the northwest corner of Africa, was a perpetual menace to the peace of Europe. Bounded by Algeria, the Mediterranean, the Atlantic, and the Sahara, and with an area about the size of France, it was a land of great agricultural possibilities, and with unknown mineral wealth. But never was a realm so picturesquely misgoverned as this independent sultanate. There was practically no law except the sultan's whim. He appointed a horde of greedy ministers or *wazirs*, who in turn appointed governors of provinces, who in their turn selected the town officials and village sheiks. No salaries were paid. The lesser officials grabbed what they could by bribery and extortion from the poverty-stricken population. They were then forced by the higher-ups to disgorge a great portion of their loot, whereupon the sultan extracted the lion's share from the higher-ups. The decisions of judges in the "courts of justice" were bought and sold like so much grain; the man who bid the highest was always right.

Powerful bandits were allowed to infest the country. In 1905, for instance, the notorious Raisuli captured Ion Perdicaris, a naturalized American citizen, and demanded $70,000 ransom. Secretary of State John Hay, with his famous message: "Perdicaris alive or Raisuli dead," compelled the sultan of Morocco to pay the ransom himself.

The rival interests of European powers—France, Germany, and Spain especially—gave rise to what was called "the Morocco question." France came to be regarded as having special interests in the country because of the dangers to French capital invested and to French rule in Algeria from the continued anarchy in Morocco. In 1905 Germany suddenly demanded a reconsideration of Moroccan affairs, and her threat of war produced a conference of the powers at Algeciras in Spain in 1906—which practically upheld the position of France. Then in 1911 Germany again brought Europe to the verge of war by sending her gunboat *Panther* to Agadir (on the Atlantic coast), in violation of what France considered to be her right in the country. France and Germany mobilized their armies, and only when Great Britain let it be understood that she supported France did Germany agree

to a peaceable settlement. By this she recognized a French protectorate over Morocco, in return for the cession to Germany of a large area of French territory in central Africa. The aggressive party in Germany remained dissatisfied, however, and the war cloud of 1911 helped produce the whirlwind of 1914.

SHOPPING IN TANGIER

The pedestrians have just entered the city through the Gate of the Market (Báb el Sok) and are inspecting the wares of the street vendors. Keen bargaining always precedes the sales, and purchasers must be discerning judges of quality in order not to be cheated. The principal thoroughfare of Tangier begins at this gate and runs through the city to the Gate of the Port (Báb el Marsa).

Today Morocco is a French protectorate, under a treaty accepted by the Sultan in 1912. Spanish rights, however, are recognized as paramount in a strip stretching 200 miles eastward from the Strait of Gibraltar, where Spain has long possessed the outpost of Ceuta.

Morocco is divided into two parts by the Great Atlas Mountains, which sweep parallel to the seacoast from the Atlantic to the east coast of Tunis. Jebel Ayashi (14,600 feet), the loftiest peak in northern Africa, rises in central Morocco. Protected from the hot winds of the desert by snow-clad summits, the Moroccan seaboard has a delightful and healthful climate, but the regions beyond the mountains suffer from intense heat in summer and bitter cold in winter.

Morocco produces great quantities of grapes and nearly all kinds of European and tropical fruits. Grain growing is on the increase, wheat, barley, oats, and beans having been added to *durra*, the native millet. Sheep, goats, cattle, and horses are raised in great numbers. The future of Morocco, however, is believed to lie in its rich mineral resources. Copper, iron, lead, antimony, sulphur, silver, gold, and petroleum are found in valuable quantities, and are being developed as rapidly as the interior is made safe for European residents.

The inhabitants consist chiefly of Berbers, Arabs, and Jews. The Berber mountaineers are the hardiest, most numerous, and most industrious of these people. The mixed Berber-Arab population of the coast towns are known as Moors, and are mostly descendants of the Moslems who were driven out of Spain in 1492. The large Jewish population also traces its origin to the Spanish exiles of an earlier period. Population, about 6,000,000; area, 231,500 square miles.

In ancient times Morocco was known as Mauretania, and its early Berber natives were subjects first of Carthage and then of Rome. In 429 the country was overrun by the Vandals, who introduced the system of piracy which gave the Barbary coast an evil name for 15 centuries after.

In 682 the Arab armies, carrying the green banner of Mohammed, seized Morocco. From that time forward a long and confused contest went on between the Berber chiefs and the Arab descendants of Mohammed for supremacy. At one time the rule of the sultan of Morocco was extended clear across the Sahara Desert to Timbuktu, but later the anarchy and disorder set in which persisted down to the French occupation.

In the Middle Ages Morocco was a center of learning and of industries. The city of Fez had a university as early as 859. The morocco leather, made of goat skins, was highly prized and is imitated to this day in all civilized countries.

Morris, Robert (1734–1806). The difficult task of Robert Morris, "the financier of the American Revolution," was perhaps the most important factor in the winning of American independence, next to the alliance with France and the actual fighting. Upon his success in raising money from the people, or borrowing it abroad without security, depended the possibility of carrying on the war.

Although Morris was an Englishman (of Liverpool) and a man of wealth by birth, he early espoused the cause of the colonists, and in 1765 joined in the opposition to the Stamp Act. In 1775 he was elected a member of the Second Continental Congress. As a

member of that body, the next year, he voted against the Declaration of Independence, because he considered that "it was an improper time, and would neither promote the interest or redound to the honor of America." But when the Declaration was adopted Morris signed it, and thenceforth devoted his energy and the fortune he had acquired in the banking business to make the Declaration come true. At times he even borrowed on his own credit the money needed to carry on the campaigns in the field.

From 1776 to 1778, and from 1781 to 1784, Morris managed the finances of the country—first as a member of the finance committee of Congress, and later as superintendent of finance. As one means of raising money to carry on the war, in 1781 he established in Philadelphia the Bank of North America. This was the first financial institution chartered by the United States.

In 1787 Morris was a member of the constitutional convention which sat in Philadelphia and was an ardent supporter of the new Constitution, but he declined the position of Secretary of the Treasury which was offered to him by Washington under the new government. As a result of some unsuccessful land speculations, he was by that time heavily involved in debt. These financial difficulties increased owing to the dishonesty of one of his partners and the failure of a London bank, until in 1798 he was confined in a debtor's prison. He was kept there for more than three years, and was finally released by the passage of a national bankruptcy law, in 1800, which ended imprisonment for debt in this country. He died in Philadelphia five years later, without having recovered his former financial standing.

Morris, William (1834–1896). "A man should put his heart into his work, and that work should be the kind that he can care about." This was the creed of the English poet and artist, William Morris, a practical dreamer of extraordinary energy and versatility who had a strong influence upon the literary, artistic, and social life of his time.

The young Morris was remembered by schoolfellows at Marlborough as "a thick-set strong-looking boy, with a high color and black curly hair, good-natured and kind, but with a fearful temper"; a strange boy fond of doing things with his hands, of taking solitary strolls, and of telling long stories "full of knights and fairies."

During quiet Oxford days at Exeter College he began a life-long friendship with Edward Burne-Jones, who later became a great artist. Both Morris and his friend early developed a passion for a remote ideal beauty, particularly that of the Middle Ages. Then under the influence of Dante Gabriel Rossetti, the poet-painter, Morris and Burne-Jones joined his group of Pre-Raphaelites. The Pre-Raphaelites, so praised by Ruskin, were a small body of poets and artists who broke away from the conventional insincere attitude that marked most of the art of the day, and sought inspiration in the simple genuine religious art preceding Raphael. Both in art and literature they strove for a quaint simplicity, impressionistic colors, and an odd realistic way of treating old medieval themes. Perhaps you have seen some of their colorful paintings of aloof mysterious damsels, tall and very willowy, who, clad in white and scarlet, wander through spacious gardens of lilies, sunflowers, and apple blossoms.

In 1859 Morris came out of this remote dream-world in which he had been trying his hand at poetry, architecture, and painting, and married Jane Burden, a noted beauty whom he had often painted. Not wanting any of the fashionable clumsy overtrimmed gilded and befringed house furnishings for their home, this true lover of beauty began to design his own. As a result of this, Morris, Burne-Jones, Rossetti, and others founded an establishment for making artistic household furniture (Morris chairs, etc.), and beautifully designed and colored curtains, rugs, tapestries, wall-papers, and even stained glass windows. Morris, a "master artisan," threw himself heart and soul into this work, and with the artist's insight, the craftsman's skill, and his own amazing patience and industry, refined popular taste and stimulated a truly national love of the beautiful in the common things of daily life. To him we chiefly owe the artistic revolution which banished the cheap and vulgar ostentation of mid-Victorian furniture and decoration.

Later at his famous Kelmscott Press at Hammersmith he turned out many beautifully printed and illuminated books. Among these were a number of his own; for Morris all his life was a writer of fluent and often beautiful poetry and prose. In his later years Morris came more and more to realize that the social world was "out of joint" and did what he could to "set it right" and make the world more beautiful for all. He became an active Socialist and preached the gospel that work that brought no joy was fit only for slaves. When at the age of 62 this vigorous and charming personality was overtaken by death, his body was borne to the little Kelmscott churchyard in an open haycart decked with vines and bulrushes.

Among Morris' works are: 'The Defence of Guenevere' (1858), a book full of picturesque ballads; 'The Life and Death of Jason' (1867); 'The Earthly Paradise' (1868–70), a volume of dreamy romantic narrative poems on classic and medieval themes; 'Sigurd the Volsung' (1876), an almost epic poem taken from Icelandic sources; 'Love is Enough' (1872), a mystery play; 'The Well at the World's End' (1896), one of a series of remarkable prose romances; and 'News from Nowhere' (1890), a romantic pastoral.

Morse, Samuel F. B. (1791–1872). "I wish that in one instant I could tell you of my safe arrival, but we are 3,000 miles apart and must wait four long weeks to hear from each other."

Samuel Finley Morse, a 20-year-old, homesick boy, wrote this sentence in a letter to his mother in 1811. She was in the house in Charlestown, Mass., where he had been born, and he had gone to London to study art. Perhaps it was at the moment of writing that letter that young Morse first conceived the desire

to bridge space with flying words—a desire which was later to give the world the electric telegraph.

His life was one long record of courage, integrity, patience, and faith, of poverty and struggle nobly endured in the pursuit of worthy ends. His father was a noted Congregational minister of Charlestown, a man of high education who counted among his friends no less a person than General Washington. Young Morse was educated at Phillips Academy and Yale. Courteous, studious, with his father's dignity and his mother's gracious manner, he commended himself to teachers and students alike. He showed a deep interest in chemistry and physics, especially in electromagnetism; but art was his chief concern.

It was a keen disappointment to his father when his eldest son chose to be an artist, for art in New England was looked upon at that time as a frivolous pursuit. Long years of struggle followed, but recognition came at last, and at the age of 40 Samuel F. B. Morse occupied a high place in his profession in the United States.

Love for Science Triumphs

But all this time his love for science was struggling in the back of his mind. When in 1832 he was returning from Europe in the steamship *Sully* there happened to be several men who were interested in electricity. During a discussion one day Morse suddenly suggested: "If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted by electricity." As he sat on deck, he worked out his plan in a series of drawings and explained them to his fellow-passengers. With a few minor changes, the instruments he devised that day became the models for the ones he later patented and which are now in use the world over.

Morse arrived in New York, a successful artist, with commissions awaiting him, and a life of ease, honor, and wealth before him. But he chose to disappear into a little shop in New Haven, and live long years of poverty, obscurity, toil, and ridicule in pursuit of his scientific vision. He lived alone in his shop, sleeping on a cot, cooking his own food, often going hungry. In 1837 he applied for a patent on "The American Electromagnetic Telegraph," but the "wild scheme" was thought impractical by capitalists and business men.

Recognition Comes Slowly

He went to England, France, and Russia seeking aid for his invention, but failure met him at every step. After superhuman efforts he eventually induced the United States Congress in 1843 to appropriate $30,000 to build a line from Washington to Baltimore. In May 1844, the first message was flashed over this wire. The text of this epoch-making message was: "What hath God wrought?" (*See* Telegraph.)

The inventor's labor of years was crowned with success. He was then 53 years of age. Seven years later the Western Union Telegraph Company was organized, and St. Louis was connected with Buffalo by wire. From that time on the growth of the electric telegraph was rapid. Although other men of science, both before and after 1837, in Europe as well as America, worked at the problem, Morse's system is the basis of most land telegraph systems to the present day. The code of dots and dashes now generally used is still known as the "Morse code" in honor of its inventor. The first attempt to lay a cable across the Atlantic was made in 1857 by Morse and Cyrus W. Field. Four cables parted, but the fifth was successfully laid in 1866. (*See* Cables, Submarine.)

As the inventor's fortune increased, he built a villa at Locust Grove on the Hudson. He surrounded himself with books and pictures and extensive gardens and his home became famous for its gatherings of distinguished men and women. His death in 1872 was an occasion for national mourning.

Mosaic (*mō-zā'ĭk*). Nothing shows better how men love the beautiful than their efforts to make the floors, ceilings, and walls of their homes and temples, even the pavements, artistic. This may be seen best in mosaic work, which consists of designs in colored stones or glass made by the use of small pieces fitted together and held in place by cement. The pattern or picture becomes thus practically indestructible. This art was known to the Assyrians and Egyptians and flourished during the palmy days of Rome. It was revived later, especially for churches; and came into great popularity again in Italy during the middle of the 13th century.

There has been a revival in modern times and the demand for mosaic is steadily increasing. Italy still produces some of the most beautiful mosaics, but American artists and studios have achieved distinction, and some of the finest designs ever produced are to be found in American buildings, chiefly the work of the Tiffany studios.

Florentine mosaic, used chiefly for jewelry, personal ornaments, and paper-weights, is composed of shells or stones of natural colors cut in much larger pieces than are employed in Roman mosaics.

Tesselated mosaics, used chiefly in floors such as the famous one uncovered at Pompeii, are made of small cubes of marble, glass, or terra cotta nicely fitted together.

Mos'cow, Russia. "Holy Mother Moscow," the old capital of Russia and its second city, is the center about which grew up the vast Russian Empire. In its midst stands a quaint old bell-tower, built more than 300 years ago by one of the czars to give employment to the people at a time of great famine. If you climb the 450 steps which wind through a maze of bells, large and small, to its top, you may view all Moscow spread before you. You see white churches, scores of them, each topped with bulbous domes, gilded, green, blue, or starred; white palaces clinging to the narrow winding Moskva River; crooked streets, great open spaces, and boulevards where Moscow's four encircling walls once stood; huge monasteries guarded by high walls and round towers.

MORSE HEARS THE WONDERFUL NEWS

"I have come to congratulate you," cried Annie Ellsworth, as she ran to greet Samuel Morse on his way to breakfast one February morning. "For what, my friend?" "On the passage of your bill." Thus it was that the inventor learned of Congress' decision to supply him with funds to build an experimental telegraph line. When he left the Senate late the night before, the bill seemed doomed to failure, and he was in the depths of despair. Now suddenly the long desired opportunity was his. In his joy over this success, he promised Miss Ellsworth that she should send the first message. When, a year later, he kept his promise, she sent these words, "What hath God wrought?"

contained in the Easy Reference Fact-Index at the end of this work

In the very heart of the old city is a vast open square. The east side of this, the Red Square, is walled in by shop-fronts, for this was the edge of the trading quarter of Moscow before the Bolshevist revolution of 1917 put an end to private trading. At its entrance stands a small chapel which was formerly thronged all day long by pious visitors who waited their turn to touch their lips to a most sacred *ikon*, or image, the Iberian Madonna. Hundreds of pilgrims and Muscovites stopped here a moment each day to burn a taper before the ikon and say a prayer, for Moscow was one of the most devout cities of the world.

In the market places in the midst of this section you would have seen the picturesque *muzhik* (peasant) in fur cap and sheepskin coat, side by side with the city folk in their commonplace European clothes, bargaining for shopworn wares inside some little stall. Priests in long brown robes and flowing locks wandered about in small second-hand book shops. Dark Armenians, who did a brisk business in calicoes displayed on rude little tables before their tiny stores, looked very foreign beside the tall, blond, blue-eyed, full-bearded Great Russians. Wayfarers from the Caucasus too, and Greeks, Tatars, and even Persians were not infrequent in this great meeting place for East and West.

To the west of the Red Square is the fort of the Kremlin, the keystone of Russian history. The Kremlin is a treasure house of things precious in Russian life and religion. In no other equal area in the world is there crowded such an array of historic cathedrals and monasteries, sacred relics, trophies of war, tombs of human saints and human devils, gold and silver vessels, precious stones, pearls, and jewels.

Of the five entrances in its enormous red brick walls perhaps the Gate of the Redeemer is loveliest. In olden days all religious processions left and entered Kremlin by this gate, the Metropolitan or head of the Russian church heading the group mounted on a donkey which was led by the Czar, bareheaded. So sacred was the ground within the Kremlin that the devout never put on a head-covering inside its walls. After the Revolution of 1917 it became the headquarters of the Soviet government of Russia.

WITHIN THE WALLS OF THE HISTORIC KREMLIN

Conspicuous among the old and famous buildings within the Kremlin enclosure is this great tower building of Ivan Veliky, built in the 17th century. Within are many bells, one of which weighing nearly 65 tons used to be rung when a new czar ascended the Russian throne. But this bell is a dwarf compared to the one you see standing in front of the tower—the Czar-Kolokol (Emperor of Bells), weighing more than 198 tons. It was broken in a fire before it could be hung, and its voice has never been heard.

Beyond the Kremlin is the famous old imperial university, founded in 1755. Moscow has also a new free university, which provides evening courses for those who work during the day.

Built at the intersection of six important highways, Moscow has always been a storehouse and exchange mart for the merchandise of Europe and Asia. Here before 1917 was concentrated the traffic in grain, hemp, and oils sent to the Baltic ports; in tea, sugar, and other grocery wares for the supply of more than half of Russia and most of Siberia. Here came tallow, skins, wool, metals, timber, wooden wares, iron and steel goods, drugs, raw cotton, silk, and all the other products of middle Russia. Moscow was also the principal manufacturing city of Russia, and its banks were the most important. Large numbers of workers found employment in the textile industries, and in chemical and metallurgical plants.

Moscow's history as a city dates back to the 12th century. It was the capital of all Russia from 1480 to 1711, when it was superseded by Petrograd, formerly known as St. Petersburg. The most striking event in its troubled history occurred during Napoleon's invasion in 1812, when the burning of the city forced the French to begin the disastrous "retreat from Moscow." Population before the Revolution, about 2,000,000.

MOSES. Among all lawgivers, there is one supreme name, that of Moses, the great leader and lawgiver of the Hebrews. The story of his life as told in the Bible is full of wonders. In the land of Egypt where his people were held as slaves, the cruel pharaoh ordered that every male child born to the Hebrews should be cast into the Nile. But Moses' mother put her little son in a box made of bulrushes and laid it in the reeds by the river's brink. The pharaoh's own daughter found him there and cared for him. Thus Moses was saved for his destined work of delivering his people from oppression and founding a nation.

From Egypt Moses led his people through the Red Sea and the desert wilderness to Mount Sinai. Here, according to the Biblical account, amidst flashes of lightning that enveloped the mountain in a blaze of fire and thunders that shook the earth, God gave to Moses the Ten Commandments, written upon two tables of stone. These laws, often called the *Decalogue* (from the Greek *deka*, "ten" and *logos*, "word"), formed the foundation of the civil and religious laws of the Hebrews (Exodus xx, 2–17). They turned the people away from the idolatry that they had learned from the Egyptians to a purer faith and a higher moral order. In these simple commandments are the fundamental elements of all moral law, and they have had a tremendous influence not only on the Jews, but on mankind as a whole. They form the ethical standard today of the whole civilized world.

Moses, who had led the people for 40 years in the wilderness, did not live to see them established in the Promised Land, but through the laws which he gave them and the ideals he held before them, the little wandering band of shepherds was transformed into a nation, destined to bring moral and spiritual light to the world.

PHARAOH'S DAUGHTER AND THE INFANT MOSES

Everyone knows the story of how Moses' mother hid him in the bulrushes in order to save him from the death decreed for all male-children born to the Israelites, and how Pharaoh's daughter found him. Here we see the kind-hearted Egyptian maiden gazing upon the future law-giver of the Jewish race, and directing that he be cared for. Little did she suspect that this infant would one day defy the power of Egypt and lead his people out of bondage.

Among the heroes of the nations, few exhibit such a combination of strength and spiritual nobility as Moses. He had the courage to defy the great pharaoh of Egypt, and yet he was "very meek, above all men that were upon the face of the earth." He led his people "as a father carries his child," and rarely did his patience desert him, though he was often tried by their stubbornness and folly. Enshrined in the memory of later generations, Moses was looked upon as the ideal prophet.

The first five books of the Bible, or the *Pentateuch* (meaning "fivefold") are sometimes called the five books of Moses, from the fact that their authorship was attributed to Moses. Among the Jews they are known as the *Torah*, or law, because they contain the Mosaic law. The story of Moses is told in Exodus, Leviticus, Numbers, and Deuteronomy.

How SCIENCE CONQUERED *the* DEADLY MOSQUITO

FOR ages malaria and yellow fever, spread by certain species of Mosquitoes, have ravaged earth's fairest lands. Heroes of Science have now discovered their deadly secrets, and so enable sanitarians and medical men to combat these plagues. There are many curious and instructive facts about these members of the fly family, who buzz about with drills and saws and tubes for sucking the blood of men and animals.

MOSQUITO. For ages past two species of mosquitoes have carried within their bodies the fearful creatures which have struck down millions of unhappy members of the human race. They have held whole continents back from civilization, and have made tropical countries impossible for white races. The little pools by the wayside, the little pockets of water in the waste places—what a mighty meaning they have had in the history of the world! For in them mosquitoes breed, so that these stagnant waters were the spots whence issued those dread diseases, malaria and yellow fever, that struck down whole races of men. They attacked the rich regions of the earth of greatest value to mankind, and they struck down not only the native people who inhabited them, but the carriers of civilization also—the pioneer, the planter, the trader, the missionary, and the soldier.

The *Anopheles* mosquito is now known to be the carrier of malaria. Thanks to this discovery, humanity now can and does wage war intelligently upon this dread disease.

Germs inside the bodies of these two mosquitoes have for ages been fighting against mankind. They have been, said Dr. Ronald Ross, speaking of malaria, the principal and gigantic ally of barbarism. "No wild deserts," says he, "no savage races, no geographical difficulties have proved so inimical to civilization as this disease. We almost say that it has withheld an entire continent from humanity—the immense and fertile tracts of Africa. What we call the Dark Continent should be called the Malarious Continent; and for centuries the successive waves of civilization which have flooded and fertilized Europe and America have broken themselves in vain upon its deadly shores."

In the opinion of a number of authorities, it was not the Goths or the Vandals who were chiefly responsible for the downfall of ancient Greece and Rome, but the malaria-carrying mosquitoes. Persons infected with this disease in Central Africa, returning by the Carthaginian trade routes, brought it to the shores of the Mediterranean, and mosquitoes were then infected and spread the disease through Greek and Roman lands. It was these malarial fevers that gradually broke down the racial vigor of the ancient world, and so contributed to the success of the barbarian invasions.

Indeed, the pages of history are black with the record of these terrible diseases. Yellow fever followed Columbus to America in 1493, and within the lifetime of living men, yellow fever was still raging in the same West Indies. There is a sad story of a general who lost his reason when, in spite of all he could do for his brave men, they were struck down in hundreds by this mosquito-transmitted disease as though by invisible bullets.

One traveler spoke of this disease as so terrible that it seemed as if the European carried something in his pocket which, coming in contact with the tropical atmosphere, lit up a conflagration. In Brazil it is said that there were 35,000 deaths in one year from yellow fever, and ships rotted in the harbor because their crews died and none could be found to replace them. And the ravages of malaria were equally striking in British India, in the lands about the Mediterranean, in Africa, and in America.

The "biting" apparatus of the female mosquito is much more complicated than appears at first sight. As you see, it consists of a bundle of tiny drills and saws. When not in use these are surrounded by a protecting sheath. The two curving horns at the sides are the antennae.

So, all over the tropical world, the mosquitoes have come up out of the pools and swamps and spread death and misery and disaster among mankind. And *nobody knew.* In their silent warfare against the human race the mosquitoes were winning all the time.

The Tragic Trail of Ignorance

It is pathetic to look back and think of all the wasted efforts to drive back these plagues, of all the human life and energy and thought and money that were poured out in vain attempts to drive the enemy back. Clothing and

baggage were disinfected or destroyed; ships were turned away from docks with the dying on board; thousands of tons of cargo were thrown overboard in the belief that they contained the germs of yellow fever or malaria. A pitiful thing it is to think of these desperate efforts to break the power of an unseen foe; there is nothing in all the legends of gods and witches more terrible than this (*see* Panama Canal).

It is good to come to the steps by which scientists arrived at last at a knowledge of those terrible enemies. Men had early suspected mosquitoes, but none had proved their guilt or shown how the diseases could be prevented. A French medical officer, Charles Laveran, first discovered the parasite or *plasmodium* of malaria in Algiers in 1880. The British Dr. Manson, the Italian Dr. Grassi, Dr. Ronald Ross of the British Army in India, and Dr. Walter Reed of the United States Army in Cuba, all had notable parts in these epoch-making discoveries.

How fascinating is the story of Major Ronald Ross as he sat looking through his microscope in India, seeking wearily to find in his specimens of mosquitoes the parasites which cause malaria! Working eight hours a day at his microscope, tried by the heat and tortured by flies, his sight grew dim, and his body sank with fatigue. But he still worked on, gazing intently into the dapple-winged mosquito upon which his microscope was turned. Again and again he was about to abandon the examination, when, he tells us—

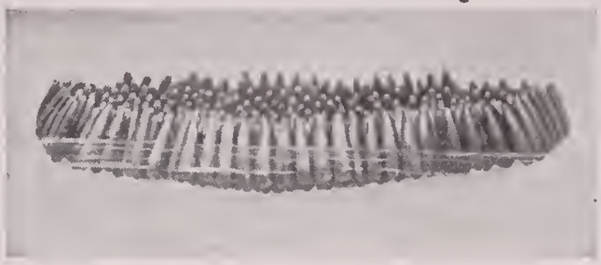
"I saw a very delicate circular cell, apparently lying among the ordinary cells of the organ, and scarcely distinguishable from them. Almost instinctively I felt that here was something new. On looking further, another and another similar object presented itself. I now focused the lens carefully on one of these, and found that it contained a few minute granules of some black substance, exactly like the pigment of the parasite of malaria. I counted altogether 12 of these cells in the insect, but was so tired with work, and had been so often disappointed before, that I did not at the moment recognize the value of the observation. After mounting the preparation, I went home and slept for nearly an hour. On waking, my first thought was that the problem was solved; and so it was."

If that moment was memorable in the life of Sir Ronald Ross, it is memorable, too, in the life of the world; for it was the beginning of the end of the *Anopheles* mosquito, the scourger of humanity, the ravager of continents, the repeller of civilization, the enemy of the Panama Canal. A new door had opened into the temple of knowledge, a new hope had come to the human race. For his work Dr. Ross was rewarded with knighthood and the Nobel prize.

While Sir Ronald Ross was searching in India and discovering the source of malaria in *Anopheles*, Dr. Walter Reed and three or four comrades in the American army were searching in Cuba for the source of yellow fever. It was almost certain, after the discovery of Sir Ronald Ross, that the disease was caused by a parasite, and that it was transmitted to man by a mosquito. How this was proved by Major Reed is one of the thrilling stories of the world.

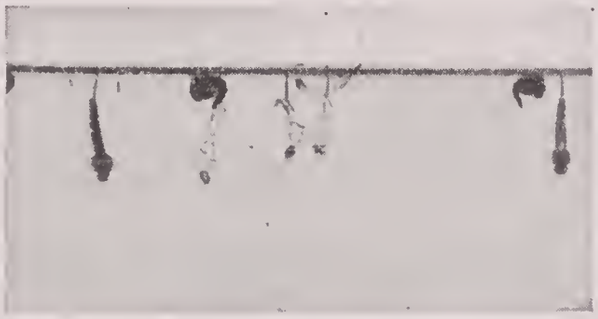
There is no adventure anywhere more instinct with heroism than the search for the means by which yellow

LIFE STORY OF A MOSQUITO

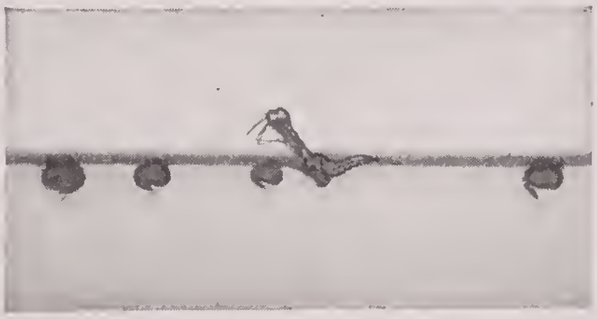


This raftlike mass is a cluster of mosquito eggs, greatly enlarged, floating upon the surface of a pond, and ready to produce mosquito larvae.

Here are several newly hatched larvae, diving into the water. They are water animals, feeding upon the minute organisms of various sorts, but they must come to the surface to breathe.



Here are several larvae becoming pupae. At the left is a larva. Next comes a pupa, with the empty larval skin attached, then two empty skins, a pupa, and another larva.



This view shows a newly formed adult mosquito crawling out of its pupa skin which floats like a little boat on the surface of the water.

Before starting on its bloodthirsty hunting life, the mosquito is stretching its legs, drying its wings, and gathering strength for its first flight to land.

fever is transmitted, and its discovery in the *Stegomyia* mosquito. Even if there had been no gain for the cause of political freedom in the Spanish-American War, the conquest of yellow fever would have been worth what that war cost a hundred times. In three years under Spanish rule, 100,000 men had died in Cuba of yellow fever; in 47 years 35,000 people had died in the city of Havana alone. It was the causes of this condition of things that Dr. Reed and his comrades were sent to investigate. One of them died, and the camp was named after him—"Camp Lazear." A great name this will be in the history of the world, if ever its real history is written; and one picture that Dr. Reed has left for us shows how the spirit of heroes and the love of humanity hovered about this camp.

Two men were wanted for experiments, and two young privates in the army came forward and offered themselves. They were to be bitten by suspected mosquitoes. Major Reed talked the matter over with them, explained the danger and the suffering, and then, seeing that they were still determined, promised that they should be generously compensated for their sacrifice. It must have thrilled Dr. Reed to find that the moment he mentioned money these American soldiers held back. Both declined to undergo the experiment except on the sole condition that they should have no money reward, for they accepted the risk "in the interest of humanity and the cause of science." Major Reed touched his cap to them, privates though they were, and said, "Gentlemen, I salute you!" He said afterwards that in his opinion their exhibition of moral courage had never been surpassed in the United States army.

One of the young men who thus took his place in a screened room of the medical experiment station at Havana and allowed an infected mosquito to thrust its tiny bill into his arm was John R. Kissinger of Ohio. He contracted yellow fever, and although the skill of Dr. Reed saved his life, the young soldier's health was wrecked for the remainder of his days. But his heroism, and the heroism of others who followed him, had established a scientific truth which has enabled men to stamp out yellow fever and save thousands upon thousands of human lives. Dr. Reed himself did not live long after this, dying in 1902 of appendicitis. In his honor is named the great government hospital in the city of Washington.

So it was that it was discovered, in 1900, that it is the *Stegomyia* mosquito which gives man yellow fever, just as it is *Anopheles* which transmits malaria. This knowledge, applied by Dr. William C. Gorgas, stamped out those twin plagues, first in Havana, and then in the Panama Canal Zone. Today the existence of these diseases anywhere in the world is a sure sign of the backwardness of the community in taking the simple steps to clear their neighborhood of these death-dealing mosquitoes.

Fortunately not all varieties of mosquitoes are disease carriers. The commonest species in the United States belongs to the genus *Culex*, and although they are annoying pests they are not believed to be spreaders of disease, in this country at least. You can recognize the malaria mosquito (*Anopheles*), which feeds only at night, by its spotted wings and by the tipped-up position of its body when resting. The yellow fever mosquito (*Stegomyia fasciata*) is a day feeder, and is distinguished by white bands on legs and back.

THE YELLOW FEVER CARRIER

The stripes on its body will enable you to recognize *Stegomyia fasciata*, the mosquito that spreads yellow fever. Recognition of this insect as the disease carrier has enabled health authorities to curb the disease which had scourged the tropics for centuries.

It should also be noted that the female mosquitoes are the only dangerous ones. With some rare exceptions the males, which may be distinguished by their large and feathery antennae or feelers, are not capable of biting, and hence do not transmit disease. So when you hear a mosquito buzzing about you, you may be almost certain it is a female. The "song" is produced by a special apparatus at the base of the wings. If the male sings at all, its note is higher and much fainter than that of the female. Each species of mosquito has its own song, which scientists in the case of many species have succeeded in catching and reproducing on musical instruments.

Wireless Telegraphy among the Mosquitoes

The feathery antennae of the males serve as ears, and with these the males are able to recognize the song of their mates. If the exact note of the female's song is sounded on a tuning fork or other musical instrument, all the males, even those which are out of human earshot, turn about and face the sound, waving their feelers aloft like plumes until they have gauged its exact direction. Then they fly directly toward it. In this way hundreds of male mosquitoes have been caught on a single piece of fly-paper, exposed beneath a vibrating tuning fork.

The manner in which mosquitoes transmit diseases is by no means simple. A mosquito of the proper species bites a diseased person and sucks up with the blood the tiny germs of the disease. These germs then undergo certain important life changes in the

HOW MOSQUITOES SPREAD MALARIA

The picture shows a much enlarged section of human skin. At the top is a hole caused by an *Anopheles* mosquito's bite, leading into the blood stream. In it are malaria spores, with one of them entering a red corpuscle. The next three corpuscles to the left show the spores developing. Below these are corpuscles illustrating the two phases in the life of the parasites. Some spores divide and form round bodies which attack other blood corpuscles creating the symptoms of the disease as shown along the dotted line. Others develop into crescent-shaped bodies, which are taken up by the bite of another mosquito. Below we see the changes which the malaria germ undergoes in the second mosquito's body, finally developing the spores which will infect another human victim.

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body of the mosquito. When the mosquito bites a human being, the germs make their way out of the mosquito into the blood of the person bitten. There they multiply rapidly and produce a second case of the disease. We must bear in mind that the period spent by the germs in the mosquito's body is absolutely necessary to their proper development. So without the mosquito we should have no malaria and no yellow fever.

The accurate knowledge of mosquitoes gained in recent years is being turned to account in the great war against them. All mosquitoes lay their eggs in water, and when the eggs hatch, the larvae or "wigglers" remain in the water for some time before developing into the winged insects. These "wigglers" are familiar to anyone who has looked into a pool of standing water in the summer time. It is in their watery breeding places, therefore, that the fight must be carried on.

There are three principal methods of fighting mosquitoes: (1) Complete destruction of their breeding places when possible, such as draining swamps, filling in old quarries or other holes where water may accumulate, removing old cans or other receptacles which may catch and hold rain water. (2) Covering wells, cisterns, rain barrels, and other domestic water containers so that mosquitoes can't reach them to lay their eggs. (3) Pouring petroleum or other floating chemicals on the surface of lakes, ponds, or stagnant streams where mosquitoes are known to breed. This last method not only prevents further egg-laying, but it also kills any larvae already in the water, for the larvae must come to the surface for air.

The malaria mosquito is the principal mosquito foe to be guarded against in the United States, for yellow fever has been pretty generally stamped out in this country. The Federal government, the separate states, especially in the South, and numerous private organizations have joined in the war upon these *Anopheles*. In many places children's brigades have been formed in the schools to hunt for and destroy mosquito breeding places.

The mosquito belongs to the two-winged or fly order of insects. Like all insects, it has six legs, and three body parts—head, thorax, and abdomen. The little drill with which the female does its work is a very complicated piece of apparatus. Although it looks like a mere thread, it is made up of no less than six separate parts, all united in a long case. When the drill is pressed against the skin, the outer case bends back, exposing the sharp probes and saws, which penetrate rapidly to the blood supply.

The pain and swelling of a mosquito bite is caused by a poison which the mosquito injects to dilute the blood. If allowed to finish its meal undisturbed, the insect will usually suck this poison back again, and the effect of the bite is much less severe.

Mosquito eggs are usually found floating in small bunches or "rafts" on the surface of the water and hatch within a few days. There are, however, mosquitoes infesting the northern woods and Arctic regions in summer which lay their eggs upon the ground. There the eggs lie, dried or frozen, until the following spring, when the melting of the snow forms pools in which they can hatch. They develop rapidly, all reaching maturity at about the same time. This accounts for the vast swarms of mosquitoes in Alaska and other arctic latitudes, where travelers, even in regions still covered with snow, are attacked by fierce and hungry clouds. Stories are told of men who have been driven insane by these northern mosquitoes, for they sometimes fill the air in such numbers that they are drawn into nostrils and mouth with every breath, while the sharp beaks search out with relentless fury every exposed part of the body.

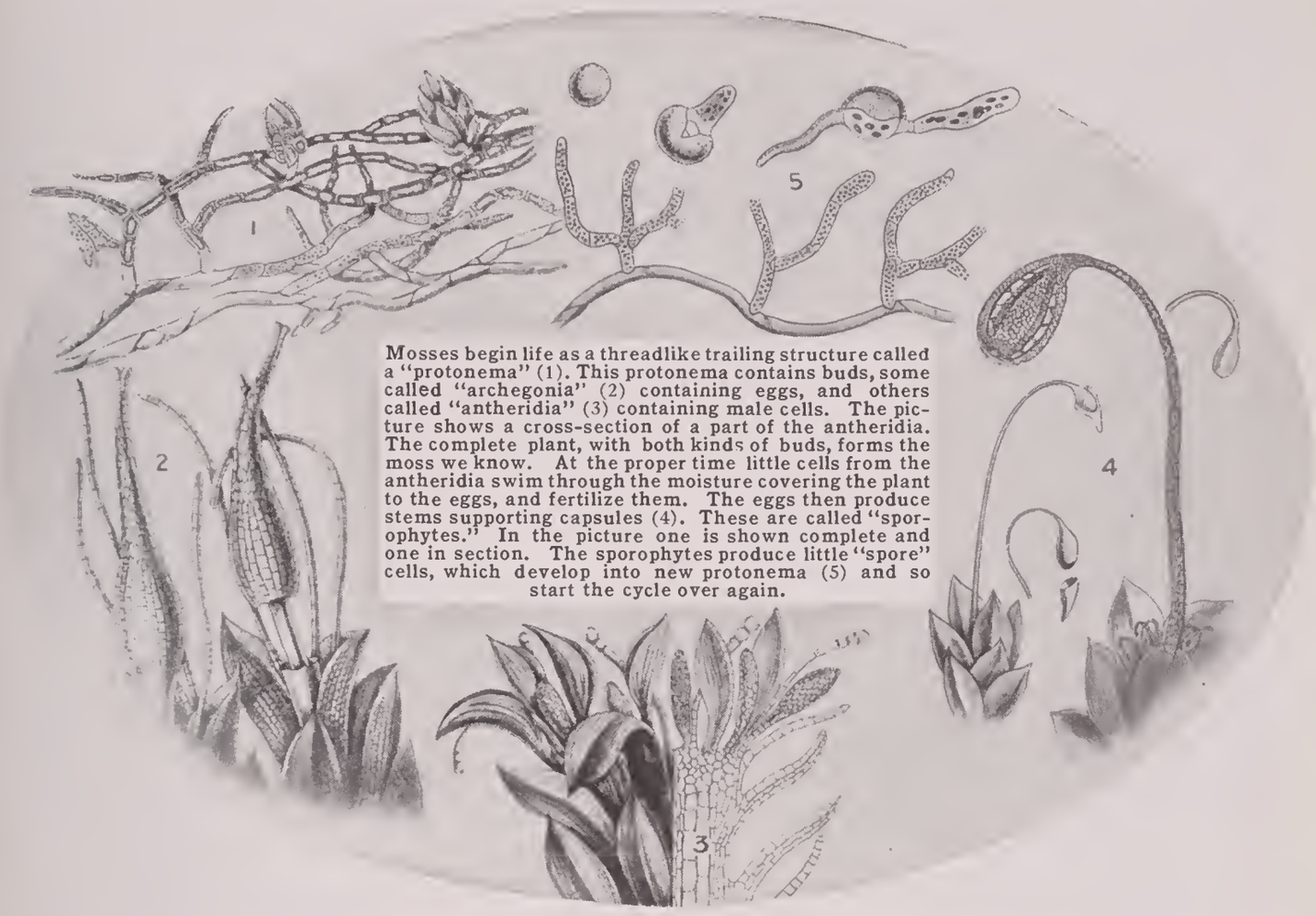
Most mosquitoes do not fly very far from the place of their birth. Certain species which breed in salt-water marshes, however, have been known to migrate long distances in huge swarms. The malaria mosquito, on the other hand, is rarely found more than half a mile from its breeding pool.

There are nearly 400 known species of mosquitoes, and few parts of the world are free from them. Breeding in the fire buckets and water tanks of ships, they have been carried even to the remote islands of the Pacific, where they were formerly unknown. But the war against them is extending its scope every year, and it is the belief of scientists that the disease-carrying species at least will some day be exterminated in all civilized countries. Many natural enemies of the mosquito aid man in the battle. Fish devour the larvae in large quantities, as do some aquatic insects. Birds and bats and dragon-flies catch great numbers on the wing.

Moss. The mosses which form beautiful green carpet-like expanses on the forest floor, or appear like brilliant green rosettes on decaying logs, wet bowlders, and dripping cliffs in our ravines and gorges, are masses of very small plants, each of which by itself resembles a tiny tree, with a single straight trunk and tiny delicately formed leaves growing out from it all the way from base to tip. Each moss plant is held in the soil and obtains its nourishment by means of a number of little threadlike roots, as is the case with the higher plants. Some mosses, instead of standing erect, trail over the ground like tiny velvety vines, which interlace and form a thick dense mat, like some heavy cloth. Mosses as a rule delight in moisture, and their habit of growing compactly together makes it possible to hold large quantities of water in storage (much as a sponge does), for use during dry periods.

Mosses are called by botanists "flowerless" plants because they do not have the showy blossoms which we are accustomed to see on many of the higher plants. The process by which they reproduce is very curious. Each moss plant grows up from a tiny green threadlike trailing structure, known as the *protonema;* this sends up little buds here and there, which develop into the moss growths with which we

THE CURIOUS LIFE CYCLE OF MOSS



Mosses begin life as a threadlike trailing structure called a "protonema" (1). This protonema contains buds, some called "archegonia" (2) containing eggs, and others called "antheridia" (3) containing male cells. The picture shows a cross-section of a part of the antheridia. The complete plant, with both kinds of buds, forms the moss we know. At the proper time little cells from the antheridia swim through the moisture covering the plant to the eggs, and fertilize them. The eggs then produce stems supporting capsules (4). These are called "sporophytes." In the picture one is shown complete and one in section. The sporophytes produce little "spore" cells, which develop into new protonema (5) and so start the cycle over again.

are familiar. In the tips of some of these moss plants grow structures called *archegonia*, in which eggs develop. In other moss plants grow still other structures, called *antheridia*, in which are developed little free-swimming cells, called sperms. When the moss plants are covered with a film of water, the little sperms go swimming, by means of little hairlike appendages (called *cilia*), over to the archegonia and there fertilize the eggs. From the egg there then grows another sort of plant, which, curiously enough, takes root right in the top of the archegonial plant where the egg was developed. This plant is known as the *sporophyte*. At the top of this sporophyte there grows a little case which contains spores. Spores are somewhat like the seeds of higher plants, but they are very minute, so that a mass of them together resembles a little cloud of dust. When the sporophyte is ripe, the little case at its tip opens, and the spores are scattered about by the wind. From each spore there grows a new protonema, completing the cycle.

BEAUTIES IN A BIT OF MOSS

If you look at moss under a magnifying glass you will see that it is far more than a carpet of green woolly stuff. Sometimes it has beautiful flowers, as shown by *Mnium hornum* to the left. Or perhaps you may discover a curious "fruit," such as that on *Byrum capillaris*. Still other mosses look like a tangled forest such as *Hypnum tamariscum* on the right.

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Mosses are often confused with the liverworts, which also grow in damp situations, like the mosses, and are of the same delicate green color (*see* Liverworts). Most of them may be distinguished from the mosses by their thicker leaves, which look rather soft and fleshy, and which usually lie flat on the ground, with little hairlike rootlets on their under surfaces. "Irish moss" is not a moss, but a seaweed, and "Iceland moss" is a lichen. The so-called "moss" on trees is mostly *lichens* (*see* Lichens). "Florida" or "Spanish moss" is a flowering plant.

The Many Kinds of Mosses

Some 5,000 species of mosses are known, distributed all over the world. Nine-tenths of them belong to the order *Bryaceae*. The other chief group, the sphagnum or bog mosses, is of considerable value to man. Their pale spongelike leaves filled with hollow cells absorb liquids with great rapidity and hence make an ideal surgical dressing with which to pack wounds. Large quantities were used for this purpose in the World War of 1914–18. The sphagnums grow in large patches in damp meadows, bogs, and swamps. When they occur along the shores of a lake or pond, they often gradually fill up the whole area with their spongy growth. Such a filled-up pond is called a quaking bog, because, like some enormous sponge, it trembles and quakes when one walks upon it. Growths of sphagnum accumulating through thousands of years formed the deposits of peat found in England, Ireland, and other countries (*see* Peat).

At the present time mosses seem rather humble members of the plant kingdom. But they played a great part in making the land fit for animal habitation. After the most primitive plants (algae and fungi) had carpeted the bare rocks and by heaping up their dead bodies provided a little store of nutritive soil, the mosses and liverworts appeared and took up the work. In time their remains provided a rich soil and thus made possible the growth of higher plants. The mosses and the higher plants together formed the material which supported animal life on land. Mosses still exercise this regenerative function when great catastrophes, such as the eruption in 1883 of the Krakatoa volcano in Java, strip the land bare of life.

The mosses belong to the division *Bryophyta*, a Greek word signifying "moss plants." This contains two classes, the class *Musci*, or true mosses, and the class *Hepaticae*, or liverworts. Two species of sphagnum common in North America are *Sphagnum compactum* and *Sphagnum acutifolium*.

MOTHER GOOSE. Who was Mother Goose? Nobody knows, yet everyone of us is acquainted with her rhymes. A widely circulated story declares that the original Mother Goose was a certain Elizabeth Goose (or Vergoose), a Boston widow. It is claimed that she sang these ditties to her infant grandson, and that the lad's father, who was a printer, published them in a book at Boston in 1719. No trace of such a book, however, has ever been found, and long before that date the name "Mother Goose" was used in France in connection with various stories and myths of a folklore character.

The first mention of this French "Mother Goose" is found in an old French poem of 1650:

> But the joyous theme in use,
> Like the tale of Mother Goose,
> In myth and fable so abounds
> It quite bewilders and confounds.

In 1679 a French writer named Charles Perrault published a book of fairy stories under the title 'Tales of Passed Times, by Mother Goose'. It contained such stories as "The Master Cat" (our "Puss in Boots"), "Little Thumb" (our "Hop o' My Thumb"), "Sleeping Beauty," and "Blue Beard." This book proved very popular and was soon translated into English. In this way the name "Mother Goose" became known to English children.

But many of the rhymes and jingles which make up our Mother Goose's melodies were already well known in England. Like all folk songs and sayings, they had been passed on from generation to generation. Finally, in 1760, a London publisher named John Newberry transferred the popular name "Mother Goose" from the fairy stories to a collection of these nursery jingles, and the rhymes have ever since borne the name of this mythical authoress.

No copy of this 1760 edition is in existence, but there is a reprint of it which bears the date of 1791. It is a tiny volume, about 2¾ inches long by 3¾ inches wide. It contains 51 rhymes, each furnished with a tiny illustration. The first American edition of Mother Goose was published in 1785, at Worcester, Mass. It is an exact reprint of the Newberry book. In 1833 a Boston publishing firm published an enlarged version, with more than twice as many jingles as were in the Newberry collection. Most of the new ones are evidently very very old. Many of them were probably copied from an English book, 'Gammer Gurton's Garland,' published in 1810.

What the Students Say About Them

Many learned men and women have given loving study to the history of these old familiar nursery rhymes. "Sing a song of sixpence," they tell us, is found in a play written in Shakespeare's time. "Jack Spratt" was a very fat churchman. "Little Bo-Peep" is an old, old children's game, in which one child shuts her eyes and the others hide from her. "Little Jack Horner," according to some, was an Englishman who secured a rich estate (the "plum") from the church in the time of Henry VIII. "Old King Cole" was a legendary British prince in the old Roman days. There was once a whole "chap-book," or early booklet, about "Simple Simon," and also about "Mother Hubbard." "Three blind mice" is found in a poem published in London in 1609; and "Tom, Tom, the piper's son," is in a song published in 1719.

So every one of these quaint jingles is seen to have its own special history; as we recite them we can think of the long long line of children, reaching back centuries and centuries, who have said these rhymes and played these games, and realize how very very old are many of the sayings, customs, and ways of living which still seem so natural to us today.

MOTION PICTURES. On the "movie" screen you can watch the development of a tiny seed or bulb from the time it is planted in the soil until it comes to completed growth; you see it sprout, grow, throw out leaves, branches, and buds, and burst into full bloom almost before the gardener would have had time to put away his trowel. It would seem as though a similar "camera magic" has directed the growth of the entire motion picture industry, for no other industry, except perhaps the automobile business, ever grew so fast. Within 20 years after the first blurred and flickering moving pictures danced on the screen before astonished audiences, the motion picture business had become one of the leading industries of the world. Only 20 years after the discovery of the method of taking snapshots of moving things, and 10 years after the first length of celluloid film was manufactured, special cameras, methods of printing and developing, and projecting apparatus—all the essentials—had been provided; fortunes were being made in the industry in Europe as well as in the United States; and an American company attracted world-wide attention by filming the first large production, 'The Passion Play', which furnished an entire evening's entertainment.

THE MEN BEHIND THE "GUN"

You seldom see on the screen the faces of the camera men, yet they are always there, behind the "gun," as the camera is sometimes called. Their work and risks are fully as great as the actors'. Here a camera man and a director have waded far into the water to "shoot" a swimming scene.

Today the "movies" (called in England and some other countries "cinema" or "cinematograph" shows) entertain millions of people, old and young, of every nationality and grade of intelligence in every corner of the world. The inhabitants of the frozen north make long journeys on snowshoes and dog sleds to see an occasional movie, and no less ardent are the native movie "fans" in India, Africa, and other lands of the tropics. Pictures speak a universal language, and fortunately the industry has a world-wide standard, so that films are easily exchanged between the different countries. In the movies you watch curiously the people of other lands at work and at play; at the same time perhaps black boys of Africa, yellow men of the Pacific Islands, and Eskimos wrapped in furs are looking just as curiously at the people and scenes and customs of your home land.

The whole world is a stage for the movie camera. You sit in a darkened room and on the screen before your eyes a polar expedition makes its way over fields of ice and snow, and without enduring the cold and braving their dangers you see the sights that those bold explorers saw. An adventurous camera man climbs mountain peaks that few would have the necessary equipment, time, and

endurance to mount, and millions later on see pictured on the screen the steep passes, the deep crevasses, and the majestic landscapes spread out above the clouds. Up in the airplane, to look with the eye of the bird upon the panoramic view below, down into the deepest mine, into the bowl of a seething volcano, into the midst of the battle, goes the movie camera and brings back a faithful report of what passed before its rapidly blinking eye.

To supply the news films, operators are stationed all over the world watching for events of local or general interest, and their films are sent in to their news service bureaus much as reporters gather news for the daily papers. When something of unusual importance occurs, the films are dispatched with haste, developed, printed, and distributed with such speed that audiences in cities hundreds of miles apart may see views of a great fire before the ruins have ceased smoking.

New fields are constantly being opened to the moving picture camera. For undersea pictures a specially constructed water-tight chamber is used in which the camera and its operator are lowered perhaps 50 feet below the surface. Brilliant lights illumine the water in front of the camera and attract the fish within range. In one undertaking of this kind the body of a horse was staked out on the bed of the sea to attract sharks into view, and when they appeared a native, accustomed to performing the dangerous feat, dived and dispatched one of the monsters with his knife, so that an actual fight between a shark and a man could be shown on the screen.

"THE HEART OF THE MOVIE" WITH A WONDERFUL SCENE

Here is one little picture, many times enlarged, from the long strip of film that is the center of all motion-picture work. No difficulty is too great for the camera men to tackle in getting scenes—not even when they are enclosed in a submarine chamber, photographing divers at work, as you see here. "The film is the thing" and in getting it, the highest ingenuity of Movieland is often needed.

When the eyepiece of a high-powered microscope is substituted for the usual camera lens, pictures of microscopic subjects, such as the fight between the white corpuscles of the blood and disease germs of various kinds, are possible. On the screen an object is easily magnified thousands of diameters, so that a flea can be made to appear as big as a house. These micro-films of the world of small things greatly aid the doctor and the man of science. The movie camera is also used with the X-ray to produce pictures of digestion and to show the action of heart and pulse and other organs. Actions too rapid to be followed by the eye, such as the movement of the wings of insects and birds or the flight of projectiles, can be analyzed when their movements are caught by the speed camera and repeated slowly on the screen.

Thus motion pictures are being used in a hundred ways to instruct as well as to entertain. In the schools

FROM THE ACTOR'S VIEWPOINT AND FROM OURS

The upper picture shows what the actor sees during the filming of a photoplay. He sees a director—the "brains" of the piece—signaling with his arms or shouting directions through a megaphone. He sees a battery of clicking cameras, groups of assistants, crowds of additional actors, hosts of workmen—standing in the midst of confused scaffolding and scattered scenery. Yet out of this noise and apparent confusion comes the picture that you see, such a picture as the one at the bottom—a magnificent scene representing Cleopatra's ancient palace on the Nile.

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DETAILS, BIG AND LITTLE, IN THE MAKING OF A MOVIE

The task of making moving pictures calls for a tremendous variety of detail. The very same picture may require the selection of an appropriate mountain for a background, the building of an entire town, such as you see here, and the working out accurately of the tiniest designs for "close-up" decorations, as these men are doing at the right. Every item, little and big, has to be carefully planned to make a truly successful film.

they are being used more and more to supplement the ordinary work of the classroom. Geography is being made into a series of travelogs, and history into screen dramas. Future generations will be able to turn back the cycle of time and see past events unrolled before their eyes, for large producers carefully preserve in storage vaults copies of important films showing scenes of historical interest. Students in a trade school or employees in an industry can more quickly learn their trade by watching a picture of experts performing the various tasks. Pictures taken while the trained fingers of a noted surgeon perform a delicate operation, or while the artist molds the clay or chisels the marble, are used to instruct in the arts and sciences. Great industries make use of the movies to show their product in use, or to show interesting processes and the good workmanship going into its manufacture. Government agencies arouse public interest in patriotic enterprises, health campaigns, improved farming methods, and similar matters through screen propaganda.

But while a limitless variety of subjects are filmed from real life, the make-believe of the drama, both serious and comic, occupies a much larger portion of the film industry. Great changes have taken place in the screen drama. In the early years of the business $25 was about the average amount spent on one production, and 300 feet of film was considered a big film. Now hundreds of thousands of dollars are expended on a large feature film, which may reach a length of 10,000 feet; and the long serial film may run 30,000 to 50,000 feet. The actors in the early films were "pick-ups," and when an actor from the regular theaters did appear on the film it meant that he was out of work and very much in need of money. They received about five dollars a day with a dollar extra for falling down stairs or taking some other special risk. Today some of the best actors in the country appear in the movies, and the highest salaries received by actors are paid in the movies, some of them running into hundreds of thousands of dollars a year.

The world's center of motion picture production is in southern California. There continuous sunshine and clear atmosphere make ideal conditions for perfect filming; and within a convenient distance lie ocean, mountains, untouched forests, desert, and jungles of tropical swamp lands, providing natural settings for all sorts of plots (*see* Los Angeles). Picturesque characters, such as American Indians, Mexicans, and the orientals of the seaport towns, are easily available. Some of the large moving picture

BRINGING SCOTLAND TO AMERICA

Of course they don't actually bring any portion of Scotland over, but the effect is just the same. In these pictures the workmen are preparing the setting for a story laid in a Scottish village. After a field had been found resembling the Scotch countryside, carpenters set to work duplicating the village, as you see in the upper picture. After the carpenters come masons and gardeners to build walls and lay out lawns and flower beds. Then the "property men" scatter around their "props"—as those wheels, broken fences, and all the incidentals of the scene are called. The result is a village street in which the native Scotchman would feel quite at home.

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colonies are almost cities in themselves, with immense studios under glass, workshops, carpenter shops, and scene-painting studios, and with thousands of actors, carpenters, mechanics, and engineers regularly employed. In one of these big movie cities 30 to 40 companies may be working at one time. A street in Venice may lie next to Chinatown, scenes from Paris, or the huts of the natives of the tropics; for when scenes of foreign lands are required in a photoplay, the workmen of the studio construct entire streets which appear in the picture so true to reality that even a globe-trotter will seldom detect a serious error. Interior scenes are taken under a battery of powerful electric lights. Costumes, furniture, and all the stage fittings are selected with great care.

Many things are seen at the movies that could not be shown on the regular stage. Actors run up the sides of steep buildings or walk upside down on the ceiling, ghostly characters suddenly appear in the midst of the scene and as easily disappear, dolls act like real actors, pencils, all sorts of tools, tables, chairs, lamp posts move about apparently without anyone's touching them. There are many simple ways of "faking" to accomplish these astonishing results. In filming a scene the camera can be stopped at any point, and the actors hold their positions while the trick character or ghost takes a position in the screen, and then the filming is continued. There is nothing to indicate where the stop was made, and when the picture is thrown on the screen the sudden appearance of the ghost seems magical. Invisible strings hold the dolls, the pencil, the tools, or other objects in various positions and they are changed between stops of the camera. Pictures are made to "fade in" or "fade out" by the gradual opening or closing of the camera shutter, by the use of shaded glass before the lens, or by the use of chemicals on the film. Real people may be made to appear the size of fairies or elves by having them act at a distance from the camera while furniture, trees, or other objects in the setting and the other characters are placed close to the camera.

The pictures of men walking up walls and on the ceilings are made by laying the walls and ceiling down

A FOREST OF GLARING LIGHTS

If you walked suddenly into a big motion picture studio when it was really busy, you would probably be blinded at first by the fierce glare of the great lamps—hundreds of them, hanging from the ceiling, sticking up from the floor, mounted on rolling projectors or fixed in great clusters to walls and partitions. Your next impression would be one of confusion and disorder, as if fragments of houses, portions of rooms, bits of furniture had been picked up by a hurricane and hurled down in jumbled heaps. But soon you would discover that each one of those little groups of walls and furnishings represented a separate interior scene, perhaps a library with a fireplace or the corner of a porch. In making such scenery the moving picture men rarely take the trouble to build any more than will actually be shown on the film.

ANYTHING TO GET A GOOD PICTURE!

Perhaps you wonder, since the film does not record music, why the man is playing the violin. You can see him crouched near the camera in the upper picture, and at the extreme right in the lower view. He is doing it because the principal actors feel that it will help inspire them with exactly the right shade of emotion in critical scenes. You can easily imagine what the violinist would play in these two scenes—the ghostly wailing tremolos for the tragic moment near the water's edge, and the wild battle notes for the fight at the sea-side. You can imagine too that the violinist doesn't always have an easy time—particularly when he is balanced on the edge of a raft and keeping out of the camera's way, as in the upper picture.

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on the floor and taking the pictures with the camera in a position overhead, and strange scenes may be taken by simply turning the camera upside down. Many pictures such as those with ferocious animals in the scene with the actors are taken by means of double exposure. For example, the scene is filmed with the actors taking their parts, and then the same film is exposed again with the animals walking about in front of a black background. Another method is to run the film through the camera with a section of the film covered by masks and then exposing it again with the masks changed so that the unexposed sections of the film are the only portions uncovered. The actions photographed at two different times appear to take place simultaneously on the same film.

When a length of film is measured off and the camera crank turned backward in filming a picture, the action on the screen appears just the opposite of the way it was performed before the camera. On the screen you see a man jump into the top of a tree carrying a heavy weight, when in fact he was swung down from the tree while the camera was reversed. The board that suddenly appears to fly up on the table was pulled off by an invisible string. The knives that stick quivering into the boards close around an actor who feigns terror are not thrown by the supposed "knife wizard," but are first placed in the boards as desired and then pulled out by strings while the camera is reversed.

Notwithstanding the many ways of "faking" pictures, actors very often perform difficult and dangerous "stunts" before the camera. On such occasions men often dress up to take the part of actresses, and other actors are substituted for the stars, because the director does not want to risk the expense and inconvenience of having a highly paid star laid up with even slight injuries during the filming of a great production. Animated cartoons are produced by photographing a series of drawings. About 1,800 drawings are required for 500 feet of film, and pictures that the artist was weeks in drawing are shown in a few minutes on the screen.

WHERE THE "MOVIE" RAIN COMES FROM

They can't wait for a rainstorm when they're making a motion picture—so they make their own rain. The truck with the engine and airplane propeller are wheeled into the proper position, the propeller is set going, and the man with the hose turns a stream of water into the blast. The result is as fierce a rainstorm as anyone could want.

The photographing is done with a camera which contains a reel of a thousand or more feet of ribbon film, little more than an inch wide. The movie camera takes a picture just an inch wide and three-quarters of an inch high, so the film moves just three-quarters of an inch for each picture. Along both margins of the film holes are punched exact distances apart, and as the operator turns a crank on the camera (usually two turns to the second), hooks reach up, catch into these holes, and jerk the film the proper distance after each exposure. The shutter is closed between each picture just the instant required to move the film this short distance. For most work the film moves and the shutter blinks open and shut 16 times a second.

The exposed film is developed just as ordinary camera films are developed (*see* Photography), except that the many yards of ribbon film are wound first on racks for convenience in handling as they are dipped in one tank after another in the process and

SOME OF THE TRICKS OF THE CAMERA MAN

The camera man rides on the shelf to film the people in the car.

These fliers are not really "in the air." A white curtain provides the "sky" and overhead wires shake the plane to imitate flight. It's really very safe.

He's not really having a tooth pulled! The frame holds his head still for a "close-up."

finally on drying racks. From this original film, the "negative," any number of "positives" may be made. They are printed on the same kind of transparent sensitized film and developed in the same manner. Machines carry the two films, one laid smoothly over the other, and hold them together while the light from a small electric bulb falls on one tiny picture after another until the long roll is printed. Then the positives are developed in the same way as the negative. Color effects—blue for moonlight, pink for sunrise, red for firelight, etc.—are obtained by tinting or toning. In tinting the entire film is passed through a dye bath which colors the clear part of the film, but does not alter the blacks of the silver deposit. In toning, the blacks are changed in color while the clear parts remain unaltered. After developing, the films are inspected and assembled. As a rule more film is taken than will appear in the final picture, so the selected portions are cut out, titles inserted and the film glued together in the desired order. From 25 to 250 copies are made of all important films, and film exchanges distribute them among the theaters much as plays and vaudeville acts are booked on the regular stage. The feature films are sent first on the circuit of the largest theaters. They are then returned to the exchange for necessary repairs and are sent to the smaller theaters for the remainder of their lives.

MAKING "TWINS" OUT OF ONE MAN

Here's an actor "talking to himself"—that is, the well dressed young man at the left and the rough-clad seaman at the right are one and the same person. You see, the "movie" story was about twin brothers who looked exactly alike. To make sure of this resemblance, the same actor played both parts. How was it done? Simply by taking one half the film with the actor playing one rôle, then reversing and exposing the other half of the film with the actor in his second rôle. The edge of the door marks the place where the two exposures meet.

In the theater the images are cast on a white screen by a projecting machine much like the old magic lantern (*see* Stereopticon). A contrivance similar to that used in the camera moves the film while a shutter is closed for an instant between each picture. The farther away the screen is, the larger the picture will appear. Usually the pictures are magnified from 2,500 to 10,000 diameters. This means that every defect in the picture is also greatly magnified. Hence the films must be kept free from scratches, and the developing and printing is done in rooms supplied with washed air to keep dust particles from settling on the films. Films are now made waterproof so that they can be washed and cleaned.

HOW THEY DO THE "IMPOSSIBLE" WITH THE CAMERA

Of course, no woman could hold a chair and a man in the air as the picture shows, but how did they get the picture? It's easy, according to the camera man who took it. First, he screened off the upper half of the film and photographed the woman grasping the leg of an empty chair. The chair was held from above and only the lower part of the legs showed on the film. Then a big box was placed beneath the chair legs, the man seated himself, the lower half of the film was screened off and the upper half was exposed. The result was the "impossible" feat you see. The chief difficulty in this case was to keep the chair in exactly the same place during both exposures.

Photographing a woman shaking hands with herself is a little harder than the "stunt" with the chair, but it is just as easy to understand. The right half of the film was screened off and the woman was photographed standing on the ground. The field of view was chosen so that all of her left arm except the hand was taken. Then the sleeve was tacked to the tree to keep it in place and the woman slipped out of her waist, put on another one just like it, and climbed up to the second position. Another actor then inserted his arm in the sleeve, thrusting out his hand which the woman grasped. When all was ready the right half of the film was exposed with the result that you see.

The films, being made of celluloid, are very easily set on fire, and in the early days fires caused by the bright light focused upon the film frequently occurred. Now the films are treated to a special process which causes them to smoke and smolder instead of bursting into flames if they are ignited. The projecting machine too has been improved so that the instant the film is stopped for any reason a gate drops, shutting off the light and consequently the heat from the film; and traps are set above and below, so that if the lighted portion of the film catches fire it cannot spread to the rest of the film. These and other devices have made fires less frequent and less disastrous, but no practicable substitute for inflammable celluloid film has been found.

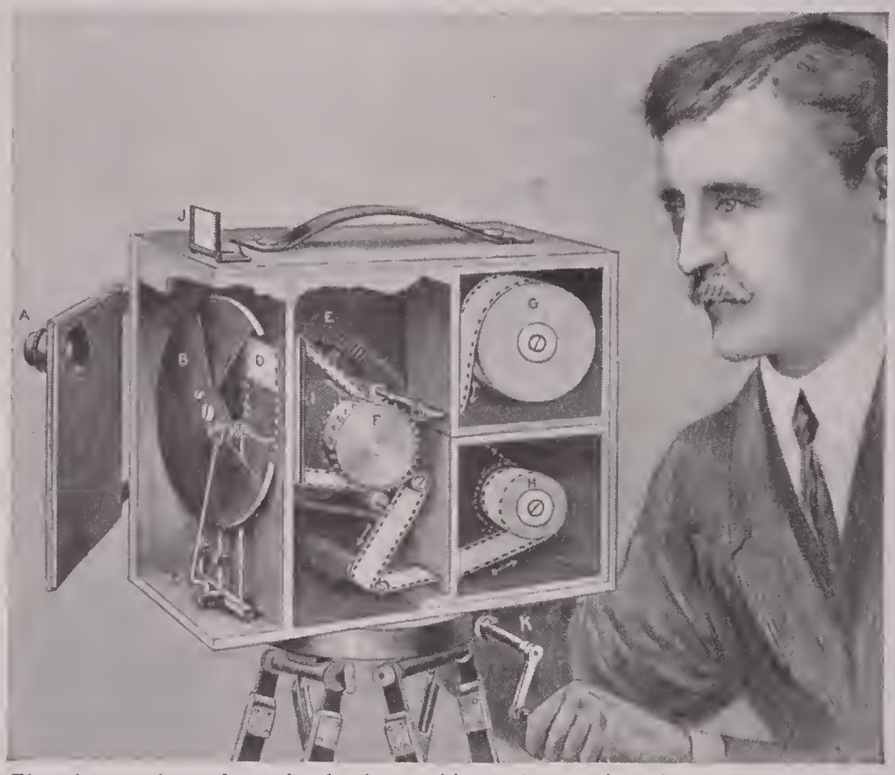
But why, you will ask, does a series of pictures projected on the screen appear as one continuously moving scene and not as a succession of pictures one after another? The answer is that the eye is tricked because of a certain defect in its operation known as "persistence of vision." The impression received by the retina of the eye lingers for a fraction of a second after the stimulus has ceased, so that in the brief interval (from one-sixtieth to one-eightieth of a second) between pictures while the screen is blank, the eye retains an impression of one picture until the next one is on the screen. In this way the pictures blend into one another so that we have the illusion of seeing one continuous picture changing only with the movement recorded by the camera.

One of the first experiments in thus tricking the eye was the children's toy called the "wheel of life" or *zoetrope*, invented in 1833. A few pictures in series were placed on the inside of a disk or a hollow cylinder, and if one looked so that only one drawing could be seen at a time while the disk or drum was whirled about, one had the illusion of seeing a moving picture. Crude as it was, such a toy can really be called the germ of the motion picture. As soon as it was found possible to take snapshots of subjects in motion, photographs instead of drawings were used in the "kinematoscope" and similar devices, and inventions and experiments continued until the modern movies were perfected.

One of the most important of these experiments was made in 1878, when Edward Muybridge, of California, set up 24 cameras a foot apart along a race course and took 24 successive snapshots of a running horse. These pictures attracted a great deal of attention, especially among artists, who were thus enabled to study the positions of moving animals. The pictures were placed in a device like the zoetrope to make a moving picture. In Muybridge's pictures the running horse remained in the middle of the screen and simply pranced up and down. In order to have the motion natural, as seen by one pair of eyes, the pictures must be taken by one camera.

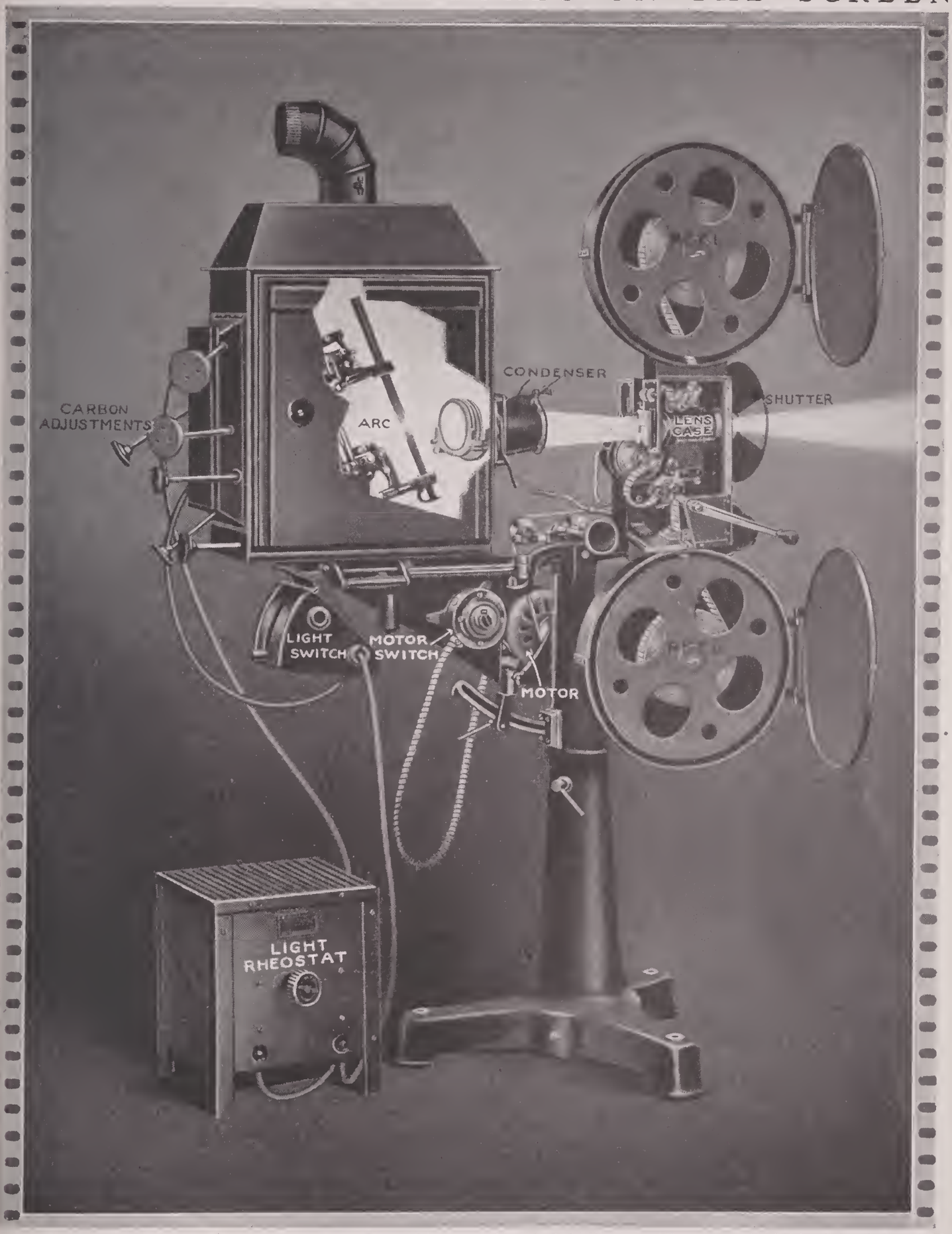
The first camera to take a series of pictures in rapid succession was the "photographic gun" used by E. J. Marey, the founder of Marey Institute in Paris. The Marey gun-shaped camera took pictures around the edge of a glass disk. Then came the second great step in motion picture history—the invention of the celluloid film to take the place of cumbersome glass plates The first film was made in 1888 and its first important application was in Edison's "peep-hole" machine (the "Kinetoscope") exhibited at the Chicago World's Fair in 1893. This was a real motion picture show on a small scale, for the only important step still to be taken was to combine this apparatus with a stereopticon apparatus to project the pictures on a screen.

THE "INSIDE STORY" OF THE CAMERA



The picture shows how simple the workings of a moving picture camera really are. The view-finder (J) enables the camera man to tell what view he is taking, and with the small crank (K) held in his left hand he keeps the instrument pointed at the desired spot. The inside mechanism is driven by a crank held in the operator's right hand. You cannot see this crank, but you can see the gear wheel (E) which communicates its motion to the inside machinery. When the crank is turned the film moves in rapid jerks, one "frame" or square at a time, from the feed spool (G) to the other (H). This jerky motion is imparted to it by a toothed wheel (F) so arranged that it moves forward click by click, its teeth being caught in the row of holes on each side of the film strip. As it unrolls, the film passes over a spring plate (I) which presses it in place against an opening (D) which is directly in the focus of the lens (A). Between this opening and the lens is a revolving shutter (B). This shutter, as you see, has an open segment which may be made larger or smaller. It is driven around by its mechanism (C), and is so timed that the open segment flashes by every time a fresh "frame" or square of film is jerked into position at D. This makes it necessary of course to have the film-winding mechanism and the shutter very carefully adjusted to each other, for they must "get together" at least 16 times every second.

THROWING THE PICTURES ON THE SCREEN



Whenever you are watching a "movie" you may know that somewhere in a booth or small room at the back of the theater is a wonderful machine like this one, "shooting" out the pictures through a tiny slit in the wall. The heart of the "projector," as this machine is called, is the powerful electric arc-light, which is adjusted by all those handles at the back and which is fed with a current regulated by the rheostat. The light passes through the condenser lenses which focus it on the film. The projecting lens then throws upon the distant screen the picture of this brilliantly lighted film. The film is pulled across the rear of this lens by motor-driven machinery. It moves in jerks just as the film did in the camera when the picture was taken. Here also is a revolving shutter, so timed that it cuts off the shaft of light while each successive "square" of the film is being jerked into place.

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THE BIRTH AND GROWTH OF A MOTION PICTURE FILM

Moving picture film is made in very much the same way as the ordinary camera film for taking snapshots. Its active life begins when it is exposed in the studio. The film does not receive its moving story continuously, as we see it in the motion picture theater. All the scenes in which the same setting is used are usually taken at the same time, even though they may come at widely separated intervals in the story. Later on each separate scene is cut apart and patched into its proper place in the reels. Usually two or more cameras photograph each incident, to be sure that at least one good picture is obtained.

LABELING THE FILM

Each separate section of the film is "labeled" by a very effective and simple process. The label, showing the number of the scene and whatever other data are desired, is photographed directly upon the film as you see here. Naturally there can be no danger of mislaying or losing it after that. This is more important than you might think, because of the many processes the film must go through and the enormous amount of film that is handled in a large studio.

DRYING THE FILM

The films are developed by being run through tanks containing the necessary chemicals, and then are wound on huge frames such as the one you see here, to dry. A section of film is on the frame for this purpose, and the man in white is inspecting it. The utmost care is used throughout to avoid blemishing or scratching the film in any way, for the slightest mark would appear enormous when the pictures, which on the film are scarcely larger than a postage stamp, are enlarged to 10 feet on the screen.

MAKING THE POSITIVE

If the developer wants to inspect the film during development, he uses a red light as shown in the left-hand picture. Red light has no effect upon the sensitive photographic chemical with which the film is coated. After the "negative" film is developed and dried, a "positive" is printed from it. This is done by running the negative through the printing machine shown in the right-hand picture, together with a blank film. At a certain point light strikes through the negative and makes a "positive" print on the blank. The two films are held together by air pressure while this is done.

For any subject not found in its alphabetical place see information

FIRST INSPECTION

When all the positives for a play are ready, they are shown on a screen, and watchers, equipped like those in this picture, scrutinize them carefully. The watchers are equipped with the script and stage directions, so they can make sure that everything is included. They also watch to see whether any defects such as scratches on the film show up in the picture. The process of editing also begins at this point. Skilled editors review all the positives, and select the exact portions which are to go into the finished film. Sometimes they only use a "flash" in place of the entire scene, and if some scenes are unsatisfactory as shown, the editors may direct that they be taken over again.

TRIMMING THE FILM

In addition to the editing, the film itself requires a lot of attention. In the picture to the right, for instance, is shown the department where surplus material is trimmed away. In many cases films require tinting, in order that they may show blue for moonlight, red for fire, and so on, when projected on the screen. When you stop to think that there are 16,000 photographs for each thousand feet of film, and that a long serial may run to 50,000 feet, you can appreciate the enormous task involved in the detailed inspection and preparation of the reels. All the fine points are worked out bit by bit, and the exact place for switching from one scene to another are carefully selected. Often the amount of film "killed" exceeds the amount used.

IN THE ART ROOM

While all the other work is going on, a busy department such as the one shown in the picture to the right prepares "copy" for the subtitles and all other "printed" words that are inserted into the film. Cleverness in subtitles is sought for quite as much as cleverness in acting, and a great deal of care and attention is given to preparing the "art-work," the decorations, and other features which make the subtitle attractive. The ideal motion picture is, of course, one that makes itself clear without the need for long printed instructions. Therefore it is essential that subtitles be "short and snappy," as the movie men put it. When finished, the copy for the title is set up, and photographed on a stretch of film, the length of film varying according to the time it takes an average person to read it.

CLEANING THE FILM

Here is a battery of machines engaged in cleaning and polishing films. In spite of all the care and precautions used, a film accumulates dust and dirt during the many handlings it must undergo, and all this must be removed as rapidly as it accumulates. As you can see, the principle of this machine is simple. On the bench against the wire screen are two sets of spools, each one driven by an electric motor. The film rises from one box, passes over the various spools and buffers, and is wound up in the other box. At this point it may be well to explain the process called "rewinding." Whenever, during the handling of a film, it is run off from one spool to another, the relative position of the pictures on the film is, of course, reversed. Then it must be rewound so that the beginning of the series of pictures shall be on the outside of the reel.

ASSEMBLING PARTS

As each portion of the film is trimmed and prepared in its final approved form, it is brought to the assembling department. Here skilled women, acting under the direction of final editors, fasten together the various parts in their consecutive order, inserting all titles and sub-titles, according to carefully prepared directions. The joints are made by applying a liquid which dissolves the surface of the celluloid. When two ends so treated are brought together in proper "register" and allowed to dry, they become like a single strip so firmly are they welded. The film is then rolled on reels ready for the final inspection.

READY FOR SCREENS

At last—perhaps months have passed since the first click of the camera—the picture is ready to go out upon its travels. The director of the studio examines it, then a trial exhibition is arranged in the studio theater. This exhibition is attended by members of the advertising department of the motion picture company, who will have to write the "ads" which will herald to the world the high qualities of the new "silent drama." At this showing also, the number of copies to be made is decided upon. A few days later the reels are sent out to the "film exchanges" and to the leading theaters. And eventually you watch it in your neighborhood theater for perhaps an hour or so, without ever stopping to think of the enormous amount of time and work spent in preparing it.

For any subject not found in its alphabetical place see information

MOTOR BOATS. Does it ever occur to you that there are water automobiles as well as land automobiles? Just as we call the land automobiles "motor cars," so we call the water automobiles "motor boats." Both "move themselves," not by steam power, but by means of a motor or internal combustion engine (*see* Gas Engine). Motor boats perform much the same function on water that automobiles do on land. Like motor cars, they may be open, or have hoods (often of awning), or closed-in "tonneaux"—cockpits, or cabins—as well as sun and wind shields. Sometimes they are as small and squatty as a rowboat, but gasoline launches are 20 to 30 feet or more long, and motor cruisers or yachts may be 60 to 100 feet or more long. They are much used in the life-saving service, and big ships, like men-o'-war, carry motor lifeboats for use in landing small parties.

The gasoline engines for motor boats, commonly of two to six cylinders, are simpler and usually heavier than those for motor cars, and are quite as efficient. They require no change-gear for various speeds, etc., and no radiator to cool the engine. The exhaust is carried to a water-cooled muffler and thence outboard. A 12-horse-power engine in a 30-foot boat may drive it ten miles an hour or more; with 20-horse-power, 16 to 18 miles may be attained. Racers with 30- to 60-horse-power motors make 30 to 35 miles an hour for short distances. A speed of 70 miles has been attained by the hydroplane motor boat, a type which rises almost out of the water and skims along.

Many of the American submarine chasers, which did so much toward winning the World War, were just big motor boats, 110 feet or so long and built usually of wood. Each was driven by three 220-horse-power motors. An auxiliary motor generated electricity and operated the pumps.

Rowboats, canoes, dories, and other small craft may be converted temporarily into motor boats by clamping onto the sternboard an outboard motor of one or two cylinders, with screw and rudder attached. It will drive an ordinary rowboat six to seven miles an hour.

MOUND-BUILDERS. Scattered over the eastern half of the United States, especially in the Mississippi valley and around the Great Lakes, are great numbers of earth mounds, many of them in regular geometrical shapes and others rudely resembling elephants, birds, snakes, and other animals. Who were the builders of these mysterious structures? Once it was believed by many that they were some unknown "lost race," distinct from the Indians discovered by the early explorers. But today scholars generally hold that the "mound builders" and the prehistoric ancestors of the American Indians were the same people. They were skilful workers in stone, shell, and beaten metal.

The mounds were evidently the work of many different tribes at widely separated periods. Some of them served as burial places, others as emblems of tribal deities or totems, as places of sacrifice, and as defenses in time of war.

The Cahokia Mound, near St. Louis, is the largest, with a base covering 17 acres and an elevation varying from 30 to 100 feet. So many mounds once existed on the site of St. Louis that it is known as the "Mound City." The Great Serpent Mound in Adams County, Ohio, is one of the most famous of the animal form mounds. Its serpentine walls are 1,350 feet long. Near Newark, Ohio, is a complicated series of structures, one of which, a circle with a diameter of more than 1,000 feet, is used as the Licking County fair grounds. Wisconsin has large numbers of animal mounds, including the celebrated Elephant Mound near Wyalusing.

MOUNTAIN ASH. When the early frosts visit the mountain woodlands the berries of this American tree take on a golden-red and join their lavish display to the autumn festival of color. Long after the leaves have fallen away, its acid berries cling to the bare twigs, brightening the snow-clad hills and furnishing food to flocks of birds that winter in the north. The winter buds are very showy and swell to a considerable size before bursting in the spring. In the early spring the crisp shining foliage appears and this is soon followed by dense clusters of small whitish-green flowers which exhale a delicate perfume. The mountain ash does not thrive in the shadow of other trees, preferring the more barren spots of rocky slope or outstanding crag. The beauty of the tree has made it valuable for garden and parking purposes. Planted in rich soil, with plenty of light and room, the mountain ash will grow a trunk often two feet in diameter, and with a height of 30 feet.

The varieties of the mountain ash are many, the American species being native from Canada southward, flourishing especially in the Allegheny highland. In addition there is a Western mountain ash, found in Canada and the western part of the United States. The mountain ash of Europe differs considerably from the American species. In Scotland it is known as the "rowan tree," and many legends cluster about it.

The mountain ash bears no relation to the common ash, but gains its name from the resemblance of its leaves to those of the ash tree.

Scientific name of American mountain ash, *Sorbus americana*. Leaves compound, alternate, odd-pinnated, bright green above, pale underneath; flowers small, white, growing in large flat cymes; fruit, bright red-scarlet berries about the size of a large pea, with black spot at apex; bark dull brown, almost smooth.

MOUNTAINS. Although a mountain is usually thought of as a peak of land rising to a high level above the surrounding country, isolated mountains are rare, the peaks being usually but points in long parallel ranges which extend for many miles like folds or tucks in the earth's surface. The loftiest mountains of the world are arranged with remarkable uniformity in two great belts, one constituting a "world girdle" and surrounding the Pacific Ocean, bordering all of the four great continents; and the other extending in an east-west direction in Eurasia. The fact that mountains occur generally near the borders of con-

tinents suggests that the settling of ocean basins due to the shrinking of the earth over a cooling interior may have been one cause of their origin. High mountains exist also submerged in the sea, many chains having been discovered in the Pacific and Indian oceans. The highest mountains in the world are the Himalayas, the highest peak being Mount Everest (29,002 feet).

Mountain ranges have been formed in several ways: (1) All the great ranges are the result of "folding," a gradual upheaval due usually to some great pressure on the sides, which bends the rock layers upward like an arch. (2) Occasionally the rocks do not bend but break, or "fault," producing mountains which are steep and clifflike on one side, with gentle slopes on the other, like many in western North America. (3) Many mountains (for example, Pikes Peak) owe their existence to the gradual work of rivers in dissecting a plateau, leaving the hard rocks standing in bold relief. (4) Volcanic cones are formed by lava eruptions (*see* Volcanoes). In the formation of many mountains all four processes have had a part. As soon as mountains begin to rise, erosion commences and continues until they are worn down to a plain, unless they are again uplifted. All lofty mountains, like the Rocky Mountains or American Cordilleras, are comparatively young. The Appalachian mountains are in a mature stage, and the Laurentian Plateau, which has been worn down almost to a plain, has reached old age.

Mountains greatly decrease the habitable area of land by their own ruggedness, and also by the aridity to which they often give rise on one side by causing the winds to drop most of their moisture before passing over them. On the other hand, however, they are the source of the great rivers which develop plains, and they furnish many valuable minerals. Lofty mountains have been almost as effective as the oceans in serving as barriers to the movement of men and animals and the spread of plants. No railway has yet been laid across the Himalayas, which for ages separated India and China from each other; and until 1910 no railway crossed the Andes. The Appalachian barrier helped to confine British colonies to the seaboard for 150 years; the Pyrenees shut off Spain from Europe so completely that it is often said, "Africa begins at the Pyrenees"; and for centuries the Alps acted as a barrier between Italy and Germany. Because of this separating tendency, and the protection which they afford from invasion, mountains frequently serve as political boundaries. (*See also* Physiography, and separate articles under the names of different mountains.)

WASHINGTON'S HOME AT MOUNT VERNON

This is the famous mansion overlooking the Potomac River where George Washington lived and where he lies buried. Thousands of visitors each year make the pilgrimage to this most venerated of America's historic relics. The estate was originally called "Little Hunting Creek Plantation," but was named Mount Vernon by Lawrence, Washington's half-brother, in honor of his former commander, Admiral Edward Vernon. George Washington had the original villa enlarged into the present mansion house and planned and superintended the construction of outbuildings and the adornment of the grounds. Many of the trees now growing on the estate were planted by Washington, Franklin, Jefferson, and Lafayette.

Mount Vernon, Va. Any American citizen who is asked today what he considers the most interesting historic spot in his country will likely reply, "Mount Vernon," the home and the burial place of George Washington. On a high bluff overlooking the Potomac River, 15 miles below Washington, we may still see this delightful old mansion-house, built of wood but painted to resemble stone. Inside you will find the rooms much as they were in Washington's time; for when the Mount Vernon Ladies' Association, in 1859, bought 200 acres of the old estate, including

the house, they undertook to restore it to the condition in which it was when "the Father of his Country" was alive. Much of the furniture, especially that in the library and in Washington's bedroom, is the furniture which he used; and in the other rooms, where the Association was unable to buy back the same furniture, they purchased articles of the same kind. The coach in the coach-house, for example, is not the one that Washington used in visiting neighboring planters, but it was built by the same man and is exactly like the one Washington owned. The grounds and the gardens surrounding the house are just as they were laid out by Washington, and some of the trees were planted by his own hand.

But although the house and the home grounds are the same as they were at the beginning of the 19th century, the princely estate that was attached is gone. Then Mount Vernon was a plantation of more than 8,000 acres, instead of the 200 acres which it now includes. The division into five farms, however, was made in Washington's time. The part we know as Mount Vernon was then included in the "Mansion-House Farm," and on this were the house of the owner, quarters for the slaves, the butler's house, and the spinning house. On each of the other farms were "an overlooker's house," quarters for slaves, barns and stables; and on one of the farms was the old fishery and the ferry to the Maryland side of the Potomac.

At first Washington, like most Virginia planters, was engaged in tobacco raising; but he soon discovered that this crop exhausted the land too much, and so turned to a variety of crops. Each year some of the land was allowed to "lie fallow," or remain idle to restore its fertility, for scientific rotation of crops was little understood either by Washington or his neighbors. On the whole, though his estate was large, it did not yield Washington a great return.

MOUSE. Here are some verses about the mouse you may not know:

All dressed in gray, a little mouse
  Has made his home within my house;
And every night, and every morn,
  I say, "I wish that mouse were gone."
But why? A quiet soul is he
  As anyone may wish to see.
My house is large, my hearth is wide,
  There's room for him and me beside.
Ah! yes; but when the lights are out
  He likes to slyly creep about,
And help himself to what he sees,
  Without once saying, "If you please."

HIS FAVORITE FOOD

Mr. Mouse has been disturbed while dining upon cheese. He looks harmless enough, doesn't he? Yet he does an enormous amount of damage.

Perhaps we shouldn't mind it so much if the little unmannerly rogue were alone, but the mouse is a social animal and likes to have his family with him. His family is not only large but it constantly increases at a surprising rate. Mice breed about six times a year, and there are about six baby mice in a litter; and the young mice breed when they are four months old. Therefore, if a pair of mice enter a home and have good luck and no deaths in their family, under normal conditions they increase in a year to 434, and at the end of the second year they number 65,778.

The house mouse was a native of Asia, but it is now found in every part of the world, wherever human beings have their habitations. It is everywhere hunted for the harm and mischief it does, but it flourishes nevertheless. The harm it does amounts to millions of dollars each year. It not only helps itself to our food, but it destroys or damages books, pictures, clothing, and furniture.

Field or meadow mice (sometimes called "voles") are larger than the house mice and more harmful but less widely distributed. They feed on grass, grain, fruit, and vegetables. Some seasons, for reasons that are not well understood, they increase abnormally and appear in such numbers that they overrun and destroy entire crops of grain, clover, or alfalfa. They also damage trees, shrubs, and flowers by gnawing the roots and bark. Large orchards are sometimes completely destroyed by them. Nurseries, vineyards, and berry plants are frequently damaged, and sometimes completely destroyed by mice.

Several species of mice are peculiar to the South, such as the harvest mouse, the rice-field mouse, and the grasshopper mouse. The latter is a beneficial form, as it lives almost entirely on grasshoppers, bugs, worms, and other mice.

One of the most interesting members of the mouse family is the Scandinavian lemming, which is remarkable for its habit of periodically migrating in vast swarms (*see* Migration).

Mice represent the smallest members of the great family known as rodents, or gnawing animals. They are harmful because of their numbers and their rapid increase. Fortunately they have many natural enemies—hawks, owls, crows, and shrikes, and cats, weasels, minks, skunks, foxes, coyotes, and bears. The great Alaskan bears spend much of their time during the summer hunting meadow mice. Scientific name of house mouse, *Mus musculus;* of meadow mouse, *Microtus pennsylvanicus.*

TALES THE WOODMAN TOLD

HOW THE MOUSE GREW SO SMALL

SUMMER had come again, and the Little Boy was very glad. As he lay on the grass, in the shade of the great sugar-maple by the side of the Woodman's cabin, he suddenly noticed that something was stirring in the grass not a foot from his nose. It couldn't be a cricket—it was too big for that. He reached over, ever so carefully, and closed his hand quickly upon the clump of grass. It was a mouse—a teeny-weeny little mouse—that he held in his hand! And it had the daintiest little white feet, and the cutest little pink nose—with funny whiskers on it! Wide-awake now, he turned to the Woodman, who was dozing in a chair by his side.

When the boy awoke he was very angry with the Sun

"Look, Mr. Woodman!" he cried, excitedly "Just see what I've caught!"

"Eh? What?" cried the Woodman, starting up and dropping his pipe. "Oh, yes! A little field-mouse; pretty, isn't it? Lots of 'em are about these fields and woods."

"I think it's *lovely*," said the Little Boy. "I'm going to take it home, and make a little cage for it, and keep it for a pet. Don't you know any story about mice, Mr Woodman?"

"Well, yes; I reckon I do," said the Woodman wrinkling up his forehead as he picked up his pipe. "Let's see. There's the story about the mouse that freed the lion from the net in which he was caught—but that was another kind of mouse, I guess. And there's the one about the mouse that frightened the elephant 'most to death; and the story about the Town Mouse and the Country Mouse. But these were just no-account barn-and-house mice, I reckon; anyway the Town Mouse was."

Then the Woodman's eyes brightened. "But there's an Indian story about how the mouse grew so small; and I 'spect that's this kind of a mouse. Want to hear that story?"

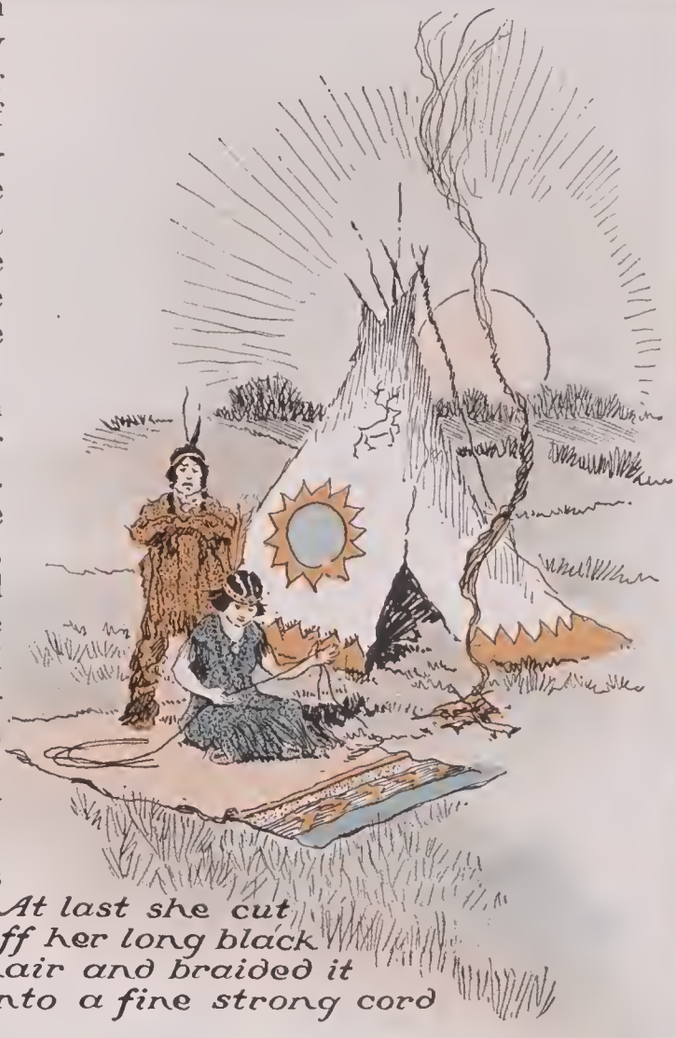
Of course the Little Boy said yes, and the Woodman began:

"Once upon a time, before the white men came to this country, there was an Indian boy and his sister who lived all alone, because their parents were dead. The little girl took care of the tepee and did the work, and the boy hunted with his bow and arrows. One winter he shot a lot of snowbirds, and his sister made a beautiful coat for him out of their skins. He was a very small boy, so it did not take many skins, small as they were, to make him a fine warm coat.

"When summer came the boy said: 'I'm going to visit my mother's people, who live far away to the west, beyond the distant hills'. So he took his bird-skin coat and set out. The ground was all soft and springy, like it is today, and a warm wind blew over the plains. By and by the boy grew tired, and lay down on a little hill. While he slept, the Sun grew hotter and beat down fiercely upon him. His fine bird-skin coat shriveled and shriveled in the heat, and soon it was no bigger than a baby's coat.

"When the boy awoke he was very angry with the Sun. His fine coat was ruined, and now he was ashamed to visit his mother's people. He went back home, and for weeks he was so sad that he could scarcely eat a bite that his sister cooked for him.

"Then one day he asked her to make a hunting snare for him. She made him one of deer sinews, like the snares used to catch rabbits. But he said it was not strong enough. Then she made him one out of rawhide rope, cut from a buffalo hide. But he said that was too heavy and coarse. At last she cut off her own long black hair, and braided that into a fine strong cord. With a noose made from that the boy was satisfied.



At last she cut off her long black hair and braided it into a fine strong cord

"Next day the boy set out, without telling his sister what he meant to do. He traveled many days, until he came to the Great Water that lay to the east. It was summer in the North Country, and the Sun rose early. The boy placed his

Soon his back began to smoke and scorch and burn

Cuddled in a nest he had made for it with his handkerchief

snare just where the Sun would touch the land when he first rose at dawn from the sea.

"Sure enough, as the Sun rose out of the sea next morning, and came to the edge of the land, he was caught and held fast in the snare that the boy had set. 'Now,' said the boy, 'I have punished the Sun for ruining my bird-skin coat.' And he went back to his home on the plains.

"All that day the Sun did not rise above the horizon. It was twilight all over the land. The animals were in great fear and wonder. Only the owl, and the beasts that roam by night, came out to look for food.

"At last the animals and birds called a council to see what could be done. When they found that the Sun was tied to the Earth by a snare, they decided that some one must cut the cord. But the Sun's heat was so great that whoever ventured near enough to do this might be burned to death.

"The birds and animals drew lots to see who should make the attempt. The shortest lot fell to the Woodpecker. He flew bravely to where the Sun lay bound, and pecked and hammered at the cord as hard as he could. But the snare was made of a braid of woman's hair and it was very strong and not easy to cut. Woodpecker's head turned fiery red with the Sun's heat, and so it remains to this day. But his bill was not sharp enough to cut the cord. At last he was obliged to give up the task, and fly back to his comrades.

"Then the council called for a volunteer for the task. At that time the Mouse—so the Indians say—was the largest and strongest and bravest of all the animals in the world. So he offered to try to set the Sun free.

"The Mouse's sharp teeth were better fitted to cut the cord than was the Woodpecker's bill. Still he thought he never would get through with the job. The heat was very great, but he was ashamed to leave his task unfinished. So he stuck to it, gnawing the cord with his teeth, and cutting one hair at a time.

"Soon his back began to smoke and scorch and burn. Then he began to melt away under the terrible heat, and he grew smaller and smaller. When the whole top of his body was burned to ashes, and he had shrunk from the largest animal in the world to one of the smallest, the last hair gave way, and the Sun bounded up into the heavens. All the animals cheered, for the Mouse had saved the world!

"But ever since that time the Mouse has been one of the tiniest of animals and one of the most timid. And his back has always been the color of gray ashes, because he was scorched so badly in freeing the Sun."

The Woodman ended his story. He looked up at the Sun, smiling down at them from the sky, and nodded as he lighted his pipe.

The Little Boy looked at the tiny field mouse, cuddled in a nest which he had made for it with his handkerchief. Then he sighed and said:

"I s'pose that's just a fairy story. But anyway I think I'll not make a cage for my mouse, but let it go."

With that he put the trembling mouse gently down on the ground. For nearly a minute he could see the grass waving as the little creature scampered happily away to its hidden nest and babies.

Mozart (*mō'tsärt*), Wolfgang Amadeus (1756–1791). A winning child genius, petted by sovereigns and princesses, a brilliant youthful composer, acclaimed by his peers as "the musician of musicians" and "the only *musician* in the world"—the artist-drudge of a penurious emperor, harried by debt, privation and overwork to an untimely death, and allowed through cold neglect to go unattended to a pauper's grave — such were the strange contrasts in the life of the "divine" Mozart.

He was born at Salzburg, Austria, where his father was musical director for the archbishop. At the age of three he displayed such interest in the music lessons of his elder sister that the father, a thorough musician, began to give the boy regular daily lessons. When five he not only played the harpsichord well, but also had composed a number of short pieces. When seven years old he went with his family on an extended musical tour. He was a very sweet innocent child. When he slipped on the polished floor of the emperor's castle in Vienna and was picked up by beautiful Marie Antoinette, later queen of France, he said: "You are very kind; when I grow up I will marry you." Everywhere he won great applause by his organ and violin playing. From Paris he was taken to London, where his playing amazed all who heard him. During his stay of over a year in England he composed 10 sonatas for the clavier (an early form of the piano) and violin, six of which were published.

THE BOY MOZART

The young musician is shown here with his violin—the violin with which he played his way into the hearts of all Europe. This statue by the French sculptor Barrias stands in the Luxembourg Museum in Paris.

When 13 years of age Mozart was taken to Italy and for two years traveled from city to city, giving concerts. In Rome he was taken to the Sistine Chapel to hear a famous musical composition of which no copy had ever been published. After hearing it once Mozart was able to write it out entirely from memory.

While in Rome the pope conferred upon him the Order of the Golden Spur, making him, at 13, a "chevalier" or knight. When in Milan he composed an opera which was so popular that it was sung for 20 nights in succession. After his return to Salzburg, Mozart was twice recalled to Italy to direct his compositions for special occasions.

For the next 13 years he gave concerts and composed. The list of his compositions is very long, including operas, symphonies, masses, and other forms of sacred music, besides numerous smaller pieces.

At the age of 26 Mozart married. During the next five years some of his finest compositions were produced, including 'The Marriage of Figaro', and 'Don Giovanni', two of his finest operas. But although these were received with the greatest enthusiasm, the financial recompense to Mozart was comparatively small. The emperor appointed him to a position at the Austrian court, but the salary was low. His wife was extravagant and a poor business manager and Mozart found it demanded all his powers to keep his growing family from want. To help out he took pupils and produced numerous compositions, all the while filling his post at court.

Under the strain his health began to break. During the year 1791 he was engaged on three of his greatest compositions. Besides two operas, he had received a commission to compose a requiem or funeral service, the purpose of which was kept secret. The mystery surrounding the order made a strange impression on Mozart, for in his weakened condition he became convinced that it was his own death dirge that he was composing.

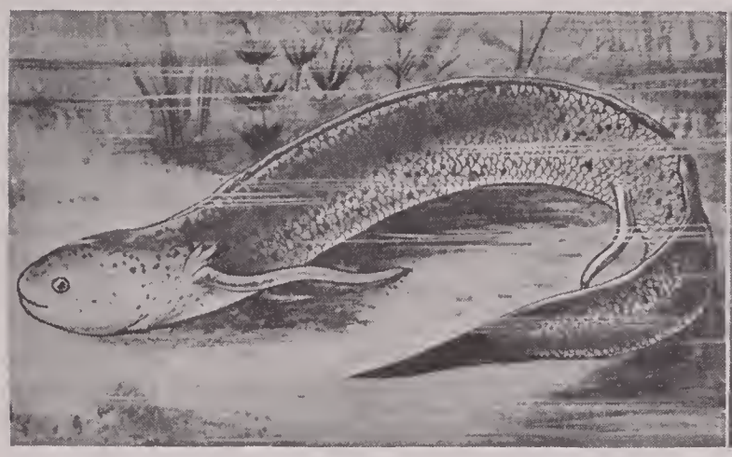
Such it proved to be, for just before it was finished the busy brilliant life of Mozart ended, apparently from typhus fever. There were debts, and there was no money. His wife was ill, and no friends came to aid. So his body was hastily buried in a pauper's grave in one of the cemeteries of Vienna.

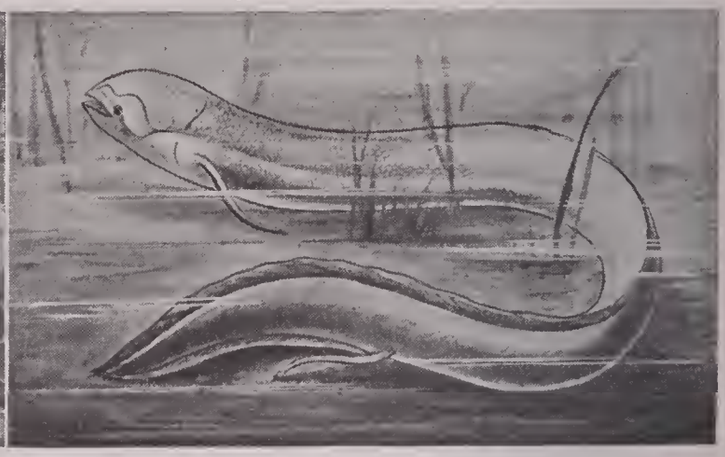
Of Mozart's operas the 'Magic Flute' is perhaps his best. Of his many symphonies the one known as the 'Jupiter' symphony is by many considered the finest, and is so masterly it is difficult to believe that it was composed in 15 days. His quartets are equaled only by those of Haydn and Beethoven. His sacred music is churchly and beautiful. The 'Requiem' is the greatest of its kind, and has been used in the funeral services of innumerable musicians.

Mudfish. "Can a fish live out of water?" "No," says the "man in the street." Then the keeper of the New York Aquarium opens a package he has just received from far-away Africa, and finds inside a ball of dried mud. It is hard to crack open, so he drops it in one of his big fresh-water tanks. The mud melts away, and suddenly, out of the black mass, a long lively, eel-shaped creature uncurls, stretches, and swims happily away, looking for food!

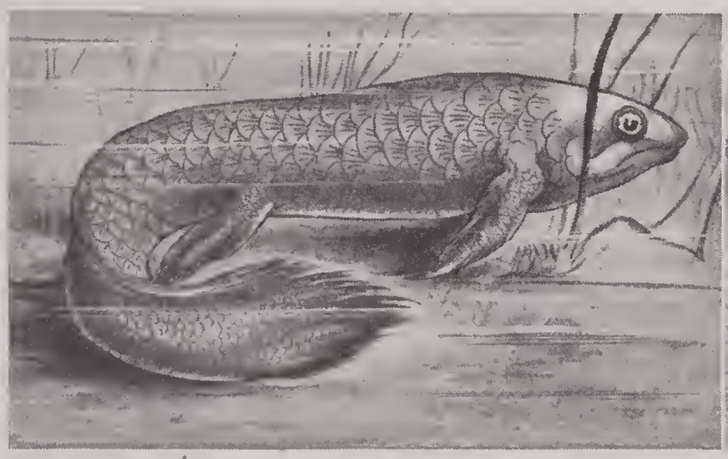
Scientists call this fish *Protopterus annectans*. The negro boys in his native land probably have a shorter name for him; but he has not yet been naturalized in America or England, so we give his family title of African "mudfish" or "lung-fish." He has a close relative living in the South American river swamps, called by the Indian natives *lolach;* and a more distant cousin in Australia, called *barramunda*.

THE QUEER MUDFISH AND THEIR QUEERER WAYS





Here are two members of the queer Lungfish order, which doesn't seem able to make up its mind whether to be fish or not. The African Mudfish on the left, for example, is a clever swimmer, yet he often ambles about in shallow water on those pipe-stem legs. The South American Mudfish on the right has a prodigious appetite, and, during the wet season, lays up fat on which he lives, buried sound asleep in the mud, during the dry season.



At the left is the Barramunda, the third living member of the Lungfish order, the *Dipnoi*. He lives in Australia, and you can often tell when he is breathing at the surface, because of the grunting noise he makes. At the right is another oddity of the fish world—the "mud skipper," or East Indian Goby. He well deserves his nickname, for he often climbs out upon a convenient log or upon the shore and hops about on those front fins of his, hunting through the weeds for insects.

This Four-Eyed Fish is in some ways the queerest of all. Do you see how his eyes are divided? The upper half is for seeing things in the air, and the lower half for seeing things under water, for this fish swims with his head half out, ready to jump after any flying insect or dive after any water bug.

These three fish are what naturalists call "anachronisms"—that is, they are survivals from an earlier day, now long out of date. When the world was several million years younger than it is today, this family of water creatures was very large, but these three widely scattered species are now the only living members. Besides the gills with which all fishes breathe under water, these fishes have lungs, which they use when their native swamps dry up in summer, or when the mud gets too thick. The African and South American lung-fishes build mud cells for themselves, and they can then be dug up and shipped long distances in these "cocoons." They are usually 12 to 18 inches long. The barramunda of Australia grows much larger,. sometimes reaching a length of six feet or more. He does not build a permanent summer cell, but uses his lungs to breathe at the surface, making a grunting noise audible at long distances. All of these fishes have front and back fins that resemble somewhat in their bone structure the four legs of lizards and frogs. They are probably survivors of a race of creatures halfway between the true fish and the newt or salamander. Although a number of other fishes have some lung-breathing power, they are not properly classed as lungfishes.

Another contradiction to the every-day rule that fish can't live out of water is the "mud-skipper" or *goby* of East Indian rivers. He is a tiny creature, with front fins developed like the flappers of a seal, who comes out on shore and hops about, hunting through the weeds for small insects, which he devours greedily. Then again there is the *four-eyed fish* of tropical America,

so-called because his eyes are divided into two parts —the upper lens suitable for sight in the air, the lower for use in the water. He swims half in and half out of water and is able to see insects above or below the surface. When alarmed, this fish will skip like a grasshopper, two feet or more at a jump.

Another strange fish of this group is the Alaskan blackfish, which sometimes reaches a length of eight inches. He dwells in the swamps, and his vitality is great. It is said that, after being frozen for weeks in baskets and then thawed out, he is as lively as ever.

"FISHING" WITH A CHISEL

Inside that hard ball of mud is an African Mudfish. He has come all the way to America in this curious house. When the man gets him chiseled out and puts him in water, he will uncoil himself and swim away as lively as you please! The picture below shows just what he looks like after he has been let out. In his native home this Mudfish rolls himself up in this mud ball during the dry weather and waits for the rainy season to melt away his prison walls.

Among the North American mudfishes are the mud-minnows, the mummichog (who belongs to the killifish family), and the bowfin, which is common throughout the central part of the United States. All have the faculty of living happily in mud and can survive a long time out of water.

Scientific names: African mudfish, *Protopterus annectans;* lolach, *Lepidosiren paradoxa;* barramunda, *Neoceratodus forsteri;* mud-skipper, *Periophthalmus koelreuteri;* Alaskan blackfish, *Dallia pectoralis.* The first three make up the lungfish group of fishes, *Dipnoi.*

Muir, John (1838–1914). Evening had fallen in the high Sierras, shutting out the clustering snow-peaks and the jutting domes of glaciated rock. The stars were very bright and very near. A little band of campers sat around their fire in the cold of a mountain night, 50 miles from the nearest village. Suddenly beside them appeared a stalwart middle-aged man, with a great beard and deep far-seeing eyes. He carried on his back a single blanket and the scantiest food. It was John Muir, the great naturalist and explorer, on one of his lonely expeditions.

Half the night the campers sat around their little fire, fascinated, listening to strange tales of the mountains and of distant lands, told with a wealth of understanding in a soft Scotch burr. In the morning when they awoke John Muir had gone, vanished into the mountains from which he came.

All who love mountains loved John Muir, for never had mountains a truer friend than he. It is largely because of him that the Yosemite and the Sequoia National parks were founded. For ten years he lived thus alone in the Sierra Nevada Mountains studying the rocks, the glaciers, and the forests, and only coming back to civilization at intervals when necessity demanded it. He discovered 65 separate glaciers and mapped out all the upper plateau.

He made several trips to Alaska, discovering Glacier Bay and Muir Glacier, and was a member of the Arctic expedition that searched for the De Long party in 1878. He also traveled in the Caucasus, Siberia, Manchuria, Japan, India, Egypt, Australia, and New Zealand. Born at Dunbar, in Scotland, he had come to America at the age of 21 and adopted the United States as his country. Four years were spent as a student at the University of Wisconsin, and he received honorary degrees from Yale and the University of California. Through his writings he awakened an interest in his beloved Sierras and carried some of their charm to thousands of readers.

Among his chief works are: 'The Mountains of California' (1894); 'Our National Parks' (1901); 'My First Summer in the Sierra' (1911); 'The Yosemite' (1912); 'Story of My Boyhood and Youth' (1913).

Mulberry. Without the mulberry tree we should have none of the exquisite silks of commerce, for the silkworm does not thrive or produce the finest quality of silk filaments for its cocoon unless it has as its food the tender leaves of the white mulberry tree. Mulberries are found in the temperate regions of both the Old and New World and are cultivated for silk growing, for the fruit, and as ornamental trees. There are three well-known species, red, black, and white, named from the color of the fruit.

These are mulberry twigs with the ripened fruit. The silkworms are put out to "pasture" on the leaves.

The white mulberry, the silkworm mulberry, is a native of China. It was brought to America when the early colonists attempted to raise silkworms. Though they failed to establish the silk-

worm culture as an industry, the white mulberry trees they imported have developed into some of the leading fruit varieties of North America. The chief centers of mulberry cultivation and of silk growing are China, Japan, India, France, Persia, and Turkey.

The black mulberry, the fruit-bearing mulberry of Europe, is not grown to any extent in the United States, though it has been known since earliest antiquity. It was introduced to Europe, it is believed, from Persia. Its large, dark purple, almost black fruit, which looks like a long slender blackberry, is very juicy and delicious.

The red mulberry, a native of North America, has fruit of a pleasing tartness, which relieves the sweetness characteristic of the fruits of all mulberry trees. In some parts of Europe this tree is cultivated in preference to other kinds because of its hardiness. None of the mulberries are planted extensively in North America, however, because the fruit is too soft to market. In some of the western United States the Russian mulberry, a variety of the white, is planted as a windbreak. Some varieties are cultivated for their ornamental forms, the most popular in America being the weeping mulberry, a lawn tree whose slender branches droop to the ground.

A member of a closely allied genus is the paper mulberry, the bark of which is used for making paper in Japan. The islanders of the Pacific also make a fabric called "tapa cloth" from it by soaking the bark, removing the outer layer, and then laying the remainder on a smooth table and beating it until it has the required thinness.

Scientific name of white mulberry, *Morus alba;* black mulberry, *Morus nigra;* red mulberry, *Morus rubra.* The trees are small, the red mulberry, the largest species, only occasionally reaching a height of 60 feet. The leaves are interesting because they are so variable. Even the same tree may bear leaves of several forms, while different trees of the same species show strong individual shapes. (*See* Silk.)

LEARNING MULTIPLICATION—*A Simplified Method*

MULTIPLICATION. When a grocer counts eggs three at a time, he says to himself, 3, 6, 9, 12, 15, 18, 21, 24, etc. Each of these numbers is called a *multiple* of 3. He is adding three at a time, and the total is made up of threes.

When a carpenter measures a board with a two-foot rule, he names the multiples of 2 in succession—2, 4, 6, 8, 10, 12, 14, etc.—until he reaches the end. He is counting by twos, that is, by multiples of 2.

A boy who has 6 nickels may count his money by naming the multiples of 5 until he reaches 30 (5, 10, 15, 20, 25, 30), or he may "short-circuit" the counting by remembering that 6 fives are 30.

Finding the sum of a number of equal numbers is called *multiplication.*

When a girl thinks 4 weeks = 28 days, she is multiplying. To multiply 7 by 4, she must remember the sum of 4 sevens (7+7+7+7). The number multiplied or repeated is called the *multiplicand.* 7 is the multiplicand in this example. The number of times that the multiplicand is repeated is the number called the *multiplier;* 4 is the multiplier in this example.

Harry counts 10 ranks of soldiers marching 4 abreast. If he knows the multiplication table (Fig. 1), he can shorten the process by saying 10 × 4 = 40. If he should forget what 10 × 4 equals, what are the multiples that he must say to find the sum of 10 fours? 4+4+4+4+4+4+4+4+4+4 = what number? What number is the *multiplicand* in this problem?

The number resulting from multiplying is called the *product;* 40 is the product of 4 and 10.

multiplicand	6
multiplier	5
product	30

Products of large numbers are found by calculating. To calculate readily the learner must commit to memory the elementary products shown above.

1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
2	2	2	2	2	2	2	2	2
2	4	6	8	10	12	14	16	18
1	2	3	4	5	6	7	8	9
3	3	3	3	3	3	3	3	3
3	6	9	12	15	18	21	24	27
1	2	3	4	5	6	7	8	9
4	4	4	4	4	4	4	4	4
4	8	12	16	20	24	28	32	36
1	2	3	4	5	6	7	8	9
5	5	5	5	5	5	5	5	5
5	10	15	20	25	30	35	40	45
1	2	3	4	5	6	7	8	9
6	6	6	6	6	6	6	6	6
6	12	18	24	30	36	42	48	54
1	2	3	4	5	6	7	8	9
7	7	7	7	7	7	7	7	7
7	14	21	28	35	42	49	56	63
1	2	3	4	5	6	7	8	9
8	8	8	8	8	8	8	8	8
8	16	24	32	40	48	56	64	72
1	2	3	4	5	6	7	8	9
9	9	9	9	9	9	9	9	9
9	18	27	36	45	54	63	72	81

Fig. 1

Eliminate the combinations in lighter type because $2\times3=3\times2$, $2\times4=4\times2$, etc., so the combinations in black type give all the variations necessary. Forty-five combinations remain. Repeat oftenest the last four lines (ten combinations in all), as they are the most difficult, viz:

6×6	6×7	6×8	6×9
	7×7	7×8	7×9
		8×8	8×9
			9×9

This table is usually known as the multiplication table. The facts it summarizes may be more easily remembered if studied in connection with drawings or other constructive work.

Developing the Multiplication Table

Cut 100 one-inch squares of paper. Lay them in rows as shown in Fig. 2.

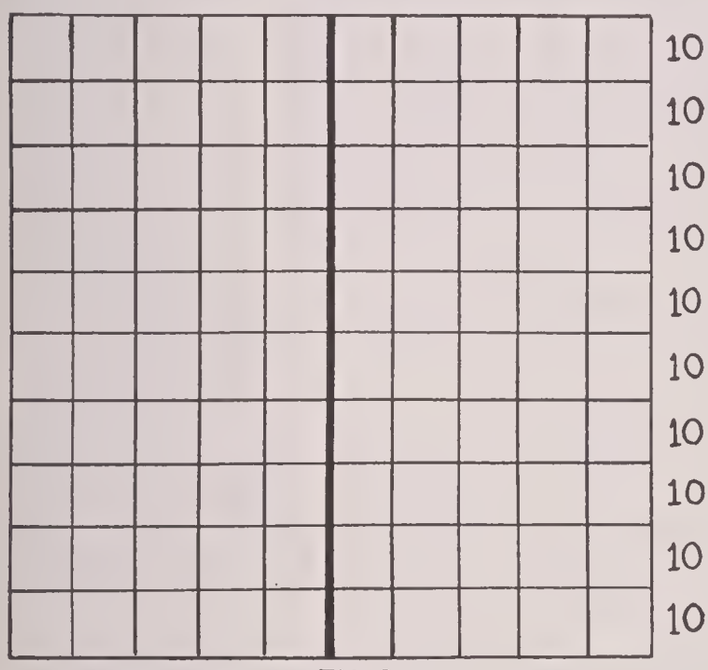


Fig. 2

1. Count the squares by rows—10 at a time—thus: 10, 20, 30, etc.

2. How many squares in 3 rows? 7 rows? 5 rows? 9 rows? 4 rows?

3. Edwin has 8 dimes. How many cents has he? 6 dimes = how many cents? 8×10 = how many? 10×10? 2×10? 5×10?

4. Copy this table and fill the blanks:

$1\times10=$	$6\times10=$
$2\times10=$	$7\times10=$
$3\times10=$	$8\times10=$
$4\times10=$	$9\times10=$
$5\times10=$	$10\times10=$

5. Lay squares in rows of 5; count them by fives.

6. Lay 5 rows of 10 squares each. Lay 10 rows of 5 squares each. How many squares in each group?

7. Compare 10×5 with 5×10. Fill the blanks: $50=$ ——— $\times5=5\times$ ———.

8. Cut two strips of paper each 10 inches long and 1 inch wide (Fig. 3). 2×10 = what number? Cover these strips with inch squares by placing 2, then 2 more, etc. How many twos = 20?

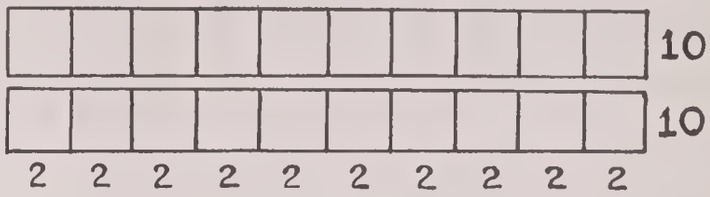


Fig. 3

Finish the table by filling the blanks:

$1\times2=$	$3\times2=$	$5\times2=$	$7\times2=$	$9\times2=$
$2\times2=$	$4\times2=$	$6\times2=$	$8\times2=$	$10\times2=$

9. Lay 2 rows of 9 squares each. 2×9 = what number? Find this number by counting the squares by twos.

10. Add:

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

Complete:

$2\times1=$	$2\times3=$	$2\times5=$	$2\times7=$	$2\times9=$
$2\times2=$	$2\times4=$	$2\times6=$	$2\times8=$	$2\times10=$

11. Lay squares to show 10 threes. Count 30 by threes. Complete the following table of threes to 10×3:

$1\times3=3$	$3\times3=9$
$2\times3=6$	$4\times3=12$

12. Show with squares that $3\times6=6\times3$; $3\times7=7\times3$; $3\times8=8\times3$; and $3\times9=9\times3$:

13. Complete the following statements by filling the blanks:

$3\times6=$	$3\times7=$	$3\times8=$	$3\times9=$

14. Add:

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

15. Lay squares and develop the tables of 4 thus:

$1\times4=4$	$4\times1=4$
$2\times4=8$	$4\times2=8$
$3\times4=12$	$4\times3=12$
$4\times4=16$, etc.	$4\times4=16$, etc.

16. In the same way make tables of 5; 6; 7.

17. How many squares on a checkerboard (Fig. 4)? Count one row. Count the number of rows. Count the black squares by fours. Count the white squares by fours. Add 32 and 32. Show that $8\times8=64$.

18. Count 32 by eights. Show that $5\times8=8\times5$. Count 48 by eights.

19. Show the product of 7×8.

Solution:

$$\begin{array}{r} 5\times8=40 \\ \underline{2\times8=16} \\ 7\times8=56 \end{array}$$

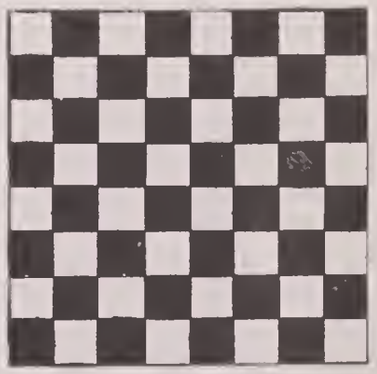


Fig. 4

20. Count 64 by eights.

21. Develop the table of nines. To count by nines, add 10 each time and subtract 1.

$2\times9=9+10-1=18$
$3\times9=18+10-1=27$
$4\times9=27+10-1=36$
$5\times9=36+10-1=45$
$6\times9=45+10-1=54$; etc.

Notice how the multiples of 9 are paired in the table at the side. Observe the table closely and tell all you can about the order of the figures, the sum of the figures in each number, etc.

09	—	90
18	—	81
27	—	72
36	—	63
45	—	54

Complete the table below:

$1\times9=9$ $\quad$ $3\times9=27$

$2\times9=18$ $\quad$ $4\times9=36$

22. Show that $3+3+3+3+3=5+5+5$.

23. Show that $5\times9=9\times5$; that $8\times3=3\times8$.

Principle. The multiplicand and multiplier can exchange places without changing the product.

Multiplying Numbers Greater than 10

Examples:

1. Find 2×12 (Fig. 5).

Solution: First form: Second form:

First form	Second form	
12	12	$2\times2=4$
12	2	2×1 ten $=2$ tens.
24 *Sum*	24 *Product*	

Answer: $2\times12=24$.

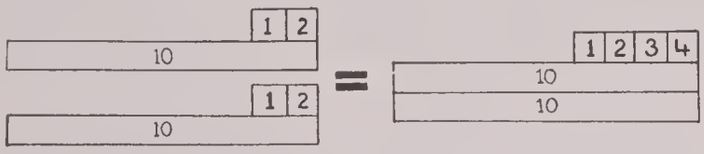


Fig. 5

2. Find 2×20. 2×30.

Solutions: 2×2 tens $=4$ tens. 2 times 3 tens $=6$ tens.

3. Find 2×27 (Fig. 6).

Solution:

27	$2\times7=14=1$ ten and 4 ones.
2	2×2 tens $+$ 1 ten $=$ 5 tens.
54	$2\times27=54$.

or:

$2\times7=14$

$2\times20=40$

$2\times27=54$

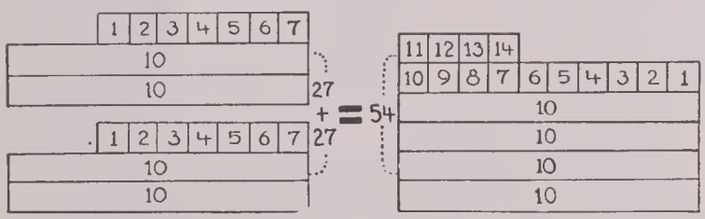


Fig. 6

Accuracy and speed in multiplication are acquired in these ways: (1) By mastering the "fundamental facts" in tables; (2) by computing with as few words as possible in mind; (3) by writing numbers in straight rows and columns; (4) by forming the habit of testing the correctness of all answers.

As an illustration of how few words it is necessary to have in mind, the following problem may be used. In multiplying 9 by 4, think "36." In multiplying 7 by 4 and adding 3, think "28," "31." In multiplying 2 by 4 and adding 3, think "8," "11."

$$\begin{array}{r} 279 \\ 4 \\ \hline 1116 \end{array}$$

In writing the partial products be careful to keep units under units, tens under tens, and so on. This is particularly important in multiplying by a number in which one or more zeros occur, as in the accompanying example.

$$\begin{array}{r} 713 \\ 402 \\ \hline 1426 \\ 2852 \\ \hline 286626 \end{array}$$

The tests used commonly to determine the correctness of a product are: (1) Repeating the operation; (2) changing the position of the multiplicand and multiplier and multiplying again; (3) dividing the product by either the multiplicand or multiplier. In either case the quotient should be the other factor.

To save time in multiplication it is convenient to know the following short cuts:

To multiply by 10, annex a zero to the multiplicand.
To multiply by 100, annex 2 zeros to the multiplicand.
To multiply by 1000, annex 3 zeros to the multiplicand.
To multiply by 25, annex 2 zeros and divide by 4.
To multiply by 50, annex 2 zeros and divide by 2.
To multiply by $12\frac{1}{2}$, annex 2 zeros and divide by 8.
To multiply by $16\frac{2}{3}$, annex 2 zeros and divide by 6.
To multiply by $33\frac{1}{3}$, annex 2 zeros and divide by 3.

Can you invent a short way of multiplying a number by 11? By 99, using subtraction?

The accompanying drill chart will help fix in your mind the facts of the multiplication table. Draw it upon your blackboard, or upon a large sheet of paper, place a number in the center for the multiplicand, and give quickly the product as someone points now to one multiplier and now to another. Change the multiplicand from time to time.

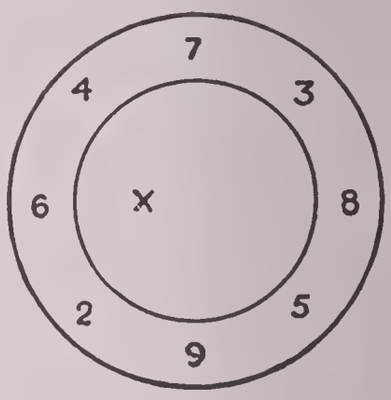


Fig. 7

Curiosities of Multiplication

Many strangely symmetrical tables have been developed by students of mathematics. One of the most interesting is that which results from the multiplication of numbers consisting entirely of 1's.

1×1	=	1
11×11	=	121
111×111	=	12321
1111×1111	=	1234321
11111×11111	=	123454321
111111×111111	=	12345654321
1111111×1111111	=	1234567654321
11111111×11111111	=	123456787654321
111111111×111111111	=	12345678987654321

From this we can form a mechanical rule for the formation of such products: To multiply a number composed entirely of 1's by itself, write the number which represents the sum of the digits in one factor (which, in order that the rule shall hold, must be less than 10), and symmetrically to the left and right of it, write the digits less than that one, in natural decreasing order. For example, to multiply 11111 by 11111, write 5, the number of digits in either factor, and symmetrically to the right and left of it, the natural decreasing order of digits less than 5, i. e., 4, 3, 2, and 1, which give the product 123454321.

Other interesting tables are these:

7×7	=	49
67×67	=	4489
667×667	=	444889
6667×6667	=	44448889
etc.		
9×9	=	81
99×99	=	9801
999×999	=	998001
9999×9999	=	99980001
etc.		

For any subject not found in its alphabetical place see information

Mummy. In the great museum of Egyptian antiquities at Cairo, throngs of curious sightseers daily look into the very faces of the pharaohs and nobles of Egypt who ruled from 3,100 to 3,500 years ago. Thousands of such mummies or embalmed bodies have been taken from the sands and tombs of Egypt, and perhaps millions more yet lie hidden; for the Egyptians practiced the art of mummifying their dead for 3,000 years or more, believing that the soul would some day return to the body and occupy it again. The bodies were preserved by the use of bitumen, spices, gums, etc., or sometimes by immersion in honey; and after a 70-day process were wrapped carefully in linen. Then the shrouded mummy was usually placed in two cases of cedar, or of a sort of papier-mâché made to fit the corpse. The inner case was plain, but the outer one was often covered with elaborate paintings and hieroglyphs telling of the life and various deeds of the deceased. A molded mask of the dead or his portrait on linen or wood sometimes decorated the head end of the case. This double case was placed in an oblong coffin and deposited in a sarcophagus. The bodies of the poor were merely dried with salt and wrapped with coarse cloths. Sacred animals—lions, dogs, crocodiles, birds, fishes, and even insects—were also mummified, and now and then whole shelves are unearthed filled with embalmed cats who centuries ago probably caught mice around the temples of Egypt.

The Egyptians surpassed in this art of preserving the body in a lifelike condition, but mummy making was practiced also in Peru and Mexico. The oldest mummy known to exist is supposed to date from about 3000 B.C. (*See* Egypt.)

Munich (*mū'nĭk*), Germany. The "Athens on the Isar" is the name the people of Munich love to give to their city of palaces, museums, and parks, situated on the Isar River, and the capital of the former kingdom of Bavaria. There are, indeed, few modern cities which come nearer to the artistic ideals of ancient Athens.

Most great cities owe their fame to advantage of location, or to some fortunate accident of history, but the greatness of Munich (German "München") is largely the result of one man's deliberate policy. Early in the 19th century, King Ludwig I of Bavaria decided to make his capital one of the leading art centers of the world. He succeeded in doing so, at enormous cost, after years of planning and labor on the part of leading architects, sculptors, and collectors.

IN THE HEART OF MUNICH

Munich is noted for its many beautiful buildings, most of them built within the last century, for this gay city on the Isar did not come into great prominence until quite recently, as time is measured in Europe. We are here looking across the Marien-Platz. The Old City Hall stands in the far background, while the front of the New City Hall just appears at the left.

The broad streets of the city today are lined with beautiful buildings copied from the world's most famous structures. And in these buildings may be studied the art and industry of mankind since ancient times. Bas-reliefs wrought by the Babylonians and Assyrians can be compared with the work of modern sculptors. On the walls of one famous gallery (in the Old Pinakothek) hang the paintings of the old masters, and just across the street (the New Pinakothek) are exhibited those of our own day. Weapons, household utensils, and other articles from the Stone Age to the present time are arranged in chronological order in the Bavarian National Museum, each room of which is built to harmonize with the period it represents, and to illustrate the march of progress through the centuries. At the Bavarian National Theater, famous musicians may be heard each night rendering the music of the great composers. The National Library contains 30,000 rare manuscripts, and 1,300,000 printed volumes. The university, the academy of science, and the schools of music and painting attract students from all parts of the world.

All this was the creation of King Ludwig. Before his reign Munich was a second-rate town, while today it ranks as the third largest city in Germany.

But the presence of so much classic art and solid learning has not made Munich a solemn city. Its people have long been renowned for their carefree gaiety, and during the carnival season, just before Lent, the whole city becomes a big playground. Masked crowds, in brilliant costumes, throng the streets and parks, and bright-colored confetti and paper streamers fill the air, as the revelers pelt each other with these harmless missiles. Special celebrations are held during the "October festival" in a park southwest of the city, where stands a bronze statue 62 feet high, representing Bavaria.

Aside from art and education, the great industry of Munich is the brewing of beer. It has been said

that if all the beer made here in one year were put into barrels, the line of these would reach from Boston clear across the United States to San Francisco. The beer is also of a superior quality, due not only to the excellence of Bavarian hops, but also to peculiarities of the water. One brewery which makes a highly esteemed beer is said to get all its water from one small spring.

Besides its beer, Munich is celebrated for artistic handicrafts, such as bronze-founding, glass-staining, silversmith's work, wood carving and lithography, the latter having been invented in Bavaria in the 18th century. Other industrial products are wall paper, railway machinery, gloves, and artificial flowers.

In the course of the revolution of 1918–19 which drove the Bavarian king from his throne and established the Bavarian republic, Munich was the scene of violent "Spartacan" (Bolshevist) uprisings. These were soon mastered, however, and an orderly republican government was established without delay. Population, about 630,000.

MUNICIPAL GOVERNMENT. When a man lives in the country, he is usually able to provide himself with the necessities of life and to determine largely his own manner of living. But as population grows in a community, new needs come into existence which concern the welfare of many people. Fire and police protection, sidewalks, street lights, and sanitation are a few of the many necessities which call for central management and a common expense fund. Usually these problems are solved by organizing the community into a village or city. This is done by the state, which issues to the community a written permit to establish a government. This permit is called a charter; it tells very definitely the powers and limitations of the new government.

The government of a village and of a city are much the same, except that the city government is more complicated. Each has three branches, the executive, the legislative, and the judicial. The mayor is usually the executive head of the city, and in American cities he possesses large powers. Under him and responsible to him are the heads of the different departments into which the government is divided, such as the police department, the water department, or the health department. The council corresponds to the legislature of the state. Its members, called aldermen or councilmen, are usually elected from the different wards of the city. As a rule, two or more members are elected from each ward for a term of two years. The powers of the council vary in different cities. In general, however, it enacts ordinances or local laws, and confirms or rejects the mayor's appointments to office. It can override a veto of the mayor by a two-thirds or a three-fourths vote. The judicial branch of the city consists of the city courts.

As a city grows, the departments increase in number and in importance and its government becomes more and more complicated and cumbersome. A number of cities, among them Galveston, Tex., and Des Moines, Iowa, have dropped mayor-and-council governments and have adopted the commission form of government. Under this method the entire responsibility for the management of the city is placed with a commission or council of a few men, usually five. This plan is simple and in most of the cities where it has been tried seems to have produced satisfactory results. The chief objection urged against it is that it permits unscrupulous men to secure too great power over public affairs and use it for their own purposes, but this difficulty is partly overcome by the use of the recall of officials. The general success of the plan is seen in the fact that it has been adopted by hundreds of cities in the United States.

A third kind of city government which has met with favor in a number of cities is called the city-manager plan. Under this system the council or commission elects a city manager to serve as head of the executive department of the government. He appoints all the subordinate executive officers under civil service rules, and in general controls the administrative side of the city's affairs. The manager may be removed at any time by the council. The city-manager plan has been tried in Dayton, Ohio, Grand Rapids, Mich., Springfield, Ohio, and more than one hundred other cities. Its chief advantage lies in conducting city government as a business rather than as a matter of politics. In general, it seems to have worked well where it has been tried.

The latest development in municipal government is the federal plan. It resembles the mayor-council system with the exception that the mayor can appoint city officers without confirmation by the council. The most important cities in which this plan is in operation are Cleveland, Ohio, and Boston, Mass. It is more democratic than the city-manager plan and its advocates claim it is equally efficient. When we remember that one-half of all the people in the United States now live in cities, it is easy to see what power for good or evil the city may become, and how important a part its government plays in our personal affairs and national life.

MURILLO (*mū-rĭl'ō*, Spanish *mu̯-rēl'yō*), BARTOLOMÉ ESTEBAN (1617–1682). A young man of about 25, footsore and exhausted from his 250-mile journey afoot across the Sierra Morena Mountains from Seville, arrived in Madrid one evening nearly 200 years ago. He was penniless, friendless, and very lonely and tired.

"Will you tell me where I can find Diego Velasquez, the court painter?" he asked a guitar player who was languidly strolling along the cobblestone road. The other eyed him with indifference as he gave the directions—not knowing that he was speaking to the man destined to be Spain's most beloved painter and one of her two world-artists.

This was a red-letter day in the life of Murillo, the poor Seville mechanic's son, who for two years had been earning a scanty living painting crude bright-colored pictures which he sold on the market place at

THE 'IMMACULATE CONCEPTION' BY MURILLO

contained in the Easy Reference Fact-Index at the end of this work

Seville, and who had pluckily set forth to seek his fortune in the capital of Spain. For on this same evening the great Velasquez, recognizing the talent of his ambitious young fellow-townsman, took the youth into his own home, and got permission for him to copy the art treasures in the royal galleries.

Murillo progressed so rapidly that in less than three years Velasquez exhibited some of his work to the king and court. He might now have looked forward to fame and prosperity in Madrid, but he preferred to return to his native Seville. Soon he executed 11 large paintings for the convent of San Francisco, which brought him immediate recognition. After this he married a rich woman of rank, became the head of the Academy of Seville, which he helped to found in 1660, and lived happily painting masterpieces—most of them religious works for the churches and convents of his beloved Seville—until a fall from a scaffold in 1681 brought injuries from which he died a year later. His body was buried in the church of Santa Cruz at Seville, and his generation mourned over the passing of their lovable, pious, popular, but unspoiled idol, their "angel painter born to paint the sky."

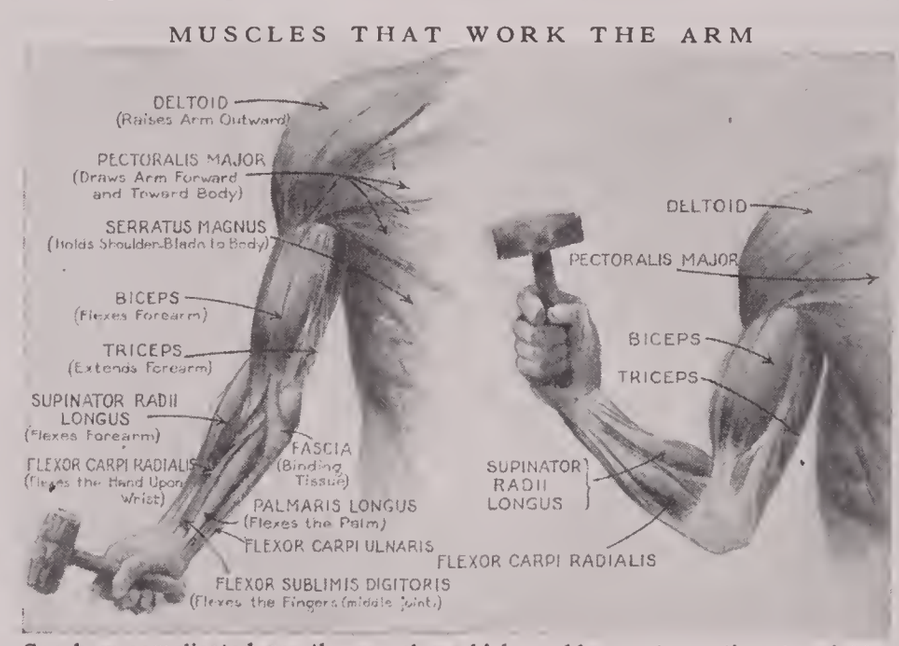
Among Murillo's earliest pictures are many sympathetic realistic studies of the ragged urchins and flower girls whom he saw on the streets of his native city. His later works are nearly all serene inspired religious compositions, marked by splendid coloring, great technical skill, and intense feeling. The few portraits he painted are of great beauty and lifelikeness. So realistic was his style that a spaniel in one of his pictures has been known to make a living dog snarl, and birds are said to peck at the lilies in his wonderful 'Saint Anthony of Padua'—that beautiful picture of the kneeling saint stretching forth his arms to the little Christ child.

Murillo's masterpiece is his world-famous 'Immaculate Conception', the artist's vision of the Virgin hovering in the clouds amid a throng of cherubs. This painting, which now enriches the Louvre, was brought from Spain during the Napoleonic wars and later sold to the French government for more than $120,000—at that time the greatest sum ever paid for a picture. Murillo painted many another masterpiece, and although Saint Anthony and the Immaculate Conception, which he painted again and again, were his favorite subjects, many admire most his beautiful paintings for the Charity Hospital of Seville, among which are 'Moses Striking the Rock', 'St. Elizabeth of Hungary Tending the Sick', and 'St. Peter Released from Prison'.

Though Murillo's work at times lacks force and originality, his love of color and sensuous beauty, as well as his pious serenity and charm, have made him one of the best loved of the world's painters.

MUSCLES. The muscles are the workmen or the "movers" of the human body, for all movement, conscious or unconscious, is accomplished by them. If we regulate the movement consciously we say the *voluntary* muscles did the work; if we cannot regulate it of our own free will we say the *involuntary* muscles performed it. Muscle tissues have a peculiar power very highly developed; this is the power of contracting and relaxing like a rubber band.

MUSCLES THAT WORK THE ARM



See how complicated are the muscles which enable us at one time to wield a heavy hammer and at another time to perform the most delicate tasks with our fingers. This picture will make you realize how important is habit, for if we had to think which of these muscles to use every time we did anything, we wouldn't get much done. But habit gained through long experience enables us to control the muscles instinctively.

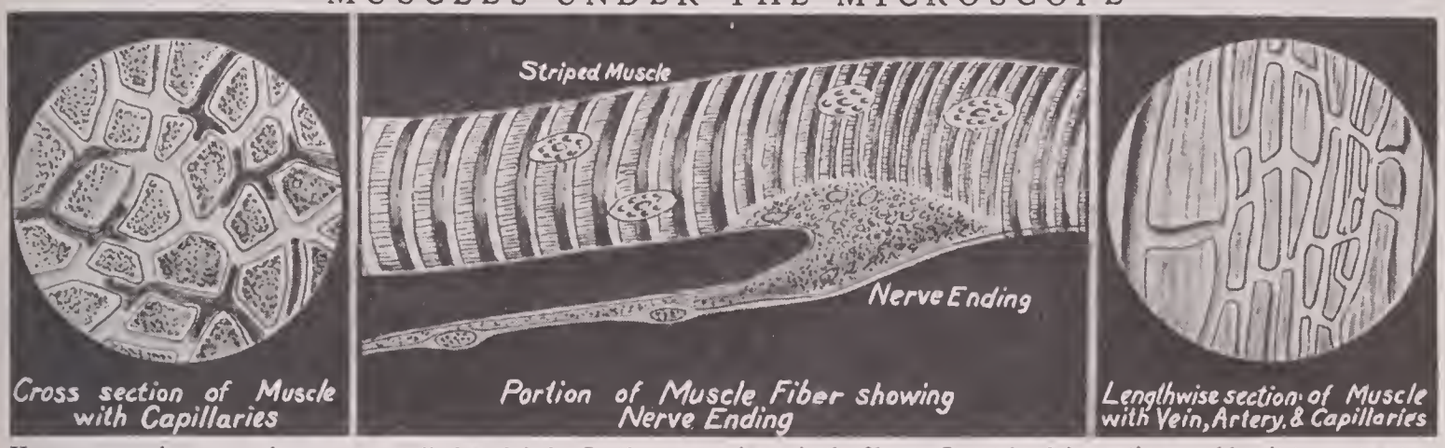
The largest muscles are those of the arms, legs, shoulders, and back. They are fastened by tendons to the bones and the sort of work they do can be best observed by studying your own arm. The biceps muscle on the front part of the upper arm is fastened by one end to the shoulder; the other end is attached to the main bone of the forearm just below the elbow. Now bend your arm at a right angle, making the muscle rigid. You can feel the hard, thin cord of the tendon right at the crook of the elbow.

At the same time, the top muscle of the forearm runs back to the outside of the upper arm, the two crossing each other over the elbow. You can push the tip of your finger between them at that spot. These muscles are simply using the bones of the arm as rigid levers to do their work.

When the forearm is thrust sharply downward, as in chopping with a hatchet, it is being pulled by the triceps muscle, which runs along the back of the upper arm and around the outside angle of the elbow.

All the muscles which are fastened to the arms and legs are voluntary muscles. They consist of bundles of fibers, each about an inch long and 1/500 of an inch wide. These bundles of fibers are enclosed in elastic

MUSCLES UNDER THE MICROSCOPE



Here we see how muscles are controlled and fed. In the center is a single fiber. Its striped formation enables it to contract or expand whenever the nerve sends in its "orders." At the left is a bundle of fibers, cut across to show how they fit together. The capillary blood vessels contain the blood which nourishes them. The picture to the right shows how the capillaries connect the arteries and veins.

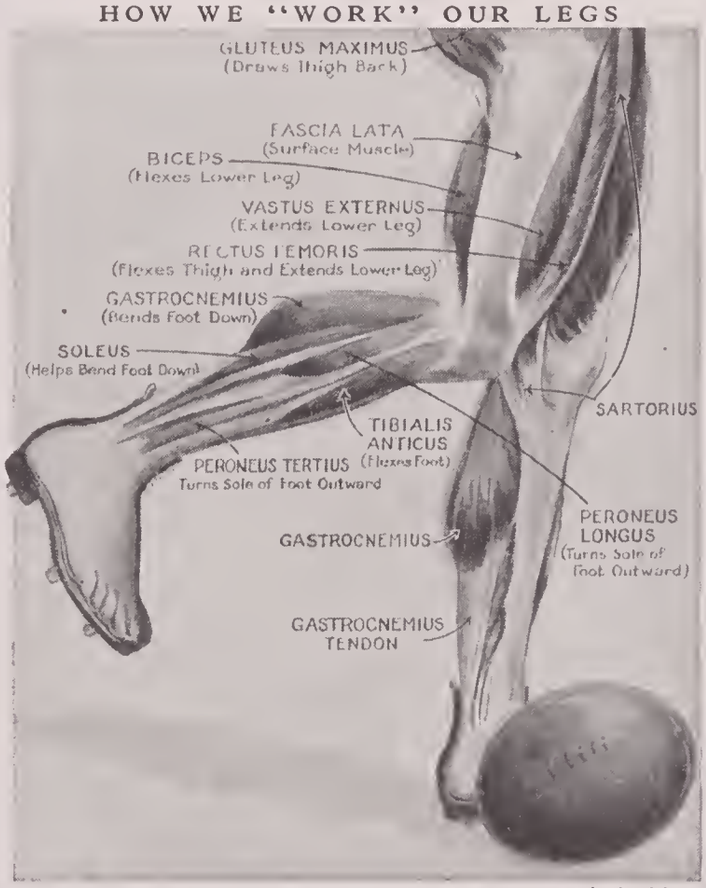
skins which hold them together and protect them. The muscles attached to the ribs of the chest share with the diaphragm muscle the work of expanding and contracting the lungs in breathing (*see* Diaphragm). These are voluntary muscles, although they continue to work through force of habit, even when we are asleep.

The heart and the muscles of the stomach and intestines and other internal organs cannot be controlled at will. They continue to work whether we wish it or not, and for this reason are true involuntary muscles. The muscles which cover the outside of the abdomen directly under the skin must not be confused with the stomach or intestinal muscles. (*See* Heart; Stomach.)

There are altogether 500 muscles in the human body. They form the "lean" flesh and constitute fully half of a person's weight. Muscles develop and become strong with use, or get weak and flabby through disuse. Exercises to train the muscles and keep them active is, therefore, the only sure road to health and strength.

A cramp in the arm or leg is due to a sudden and involuntary contraction of a muscle, which is ordinarily under control. This is usually caused by some disorder of the nerves leading from the brain (*see* Brain). Some diseases like tetanus (lockjaw) and epilepsy produce muscular spasms of this kind.

HOW WE "WORK" OUR LEGS



This picture shows most of the muscles that are used in kicking, walking, and running. The "Sartorius" is the familiar "tailor's muscle" which enables us to cross one leg over the other. It is the longest muscle in the body.

Muses. Sometimes we say that "we have an inspiration." It seems almost as though some power outside ourselves made it possible for us to think, or speak, or write, or do something better than usual. The ancient Greeks believed that this inspiration came from the Muses, goddesses who presided over the arts and sciences. So poets and musicians began their important works with a prayer to one or more of the Muses.

Though the number varies in different accounts, these divinities were generally pictured as nine maidens, the daughters of Zeus, king of the gods, and Mnemosyne (Memory). When the gods gathered in festive assembly on Mount Olympus, the Muses were always present to furnish inspiration and entertainment. Led by Apollo they sang of the origin of the world, of gods and heroes, and celebrated the glorious deeds of Zeus (*see* Apollo). On earth many places were sacred to them, especially on Mounts Parnassus and Helicon. The word "museum" in its Greek form originally meant a temple sacred to the Muses.

Calliope, the most honored of the Muses, presided over epic or heroic poetry. Clio was the Muse of history, Euterpe of lyric poetry, Thalia of comedy and pastoral poetry, Melpomene of tragedy, Terpsichore of choral song and dance, Erato of love poetry, Polyhymnia of hymns, and Urania of astronomy.

QUEER PLANTS *That Have to* STEAL THEIR FOOD

The Mysterious Mushrooms and Their Love for Damp, Dark Homes—How Mother Nature Grows Fresh Plants Almost "While You Wait!" —How to Tell the Edible from the Poisonous Varieties

MUSHROOMS. In the country perhaps you have seen a fairy ring—a circular patch covered with richer and greener grass than the rest of the meadow, or, it may be, a patch nearly bare of grass. The superstitious folk of Europe used to believe that these were the charmed circles where elves and goblins gathered for their midnight revels. But science has banished the fairies, and along with them went the poetry of the fairy rings. For now we know that these strange patches merely mark the area of certain mushrooms and other fungi, which first use up the nourishment of the soil, and later enrich it by their decay.

But the mushroom itself is scarcely less romantic and interesting than any tale of fairy-lore. What could be more wonderful than a plant that has no root, no stem, no leaves, and which springs up with such rapidity that you can fairly see it grow? Furthermore, mushrooms like other fungi have no green coloring matter (chlorophyll) by means of which most plants manufacture their food, and so they live on the food provided by animals and other plants. And then how varied their shapes and colors—flat and umbrella-like or branching like corals, and delicately tinted with reds and greens and browns!

But perhaps the fact about mushrooms that should most interest us is that while some of them are delicious food, with a flavor all their own, others contain a poison so powerful that to eat it is almost certain death. Hundreds of persons die every year from mistaking the poisonous for the edible varieties of fungi, and at least one royal personage (Czar Alexis of Russia, died 1676) is said to have been among their victims. A Roman writer tells that the Emperor Nero once killed off a whole party of guests at a banquet by feeding them poisonous mushrooms.

Those Poisonous "Toadstools" are Mushrooms Too

You often hear people refer to poisonous mushrooms as "toadstools," but the botanist does not use that term at all. He calls the higher fungi mushrooms, including the round and umbrella-shaped kinds as well as the large fleshy forms. The common idea that all mushrooms with umbrella-shaped cap are poisonous is not correct. The greater number of our mushrooms are edible, but we must be very careful when we gather them because it is easy to make a mistake.

Let us see first what mushrooms are and how they grow, and then examine some of the common edible and poisonous varieties. The part of the mushroom plant which rises above the ground is only the fruiting body of the fungus, the rest lying under the ground or rotting log in the form of a mass of dense white tangled threads, called the *mycelium* or *spawn*. These mycelium threads grow from little spores—tiny dustlike particles shed from the full-grown mushroom. Upon them bud out small whitish knobs of tissue, which push upward, expand, and finally break out in an umbrella shape, or in the characteristic form for each kind of mushroom.

On most mushrooms you will find underneath the umbrella little radiating plate-like gills, set very closely together. It is on these gills that the tiny spores are developed, which drop out, and are carried far and wide by the wind. These develop new plants when they fall upon favorable surfaces.

Most mushrooms delight to grow in moist shady woodlands, or in the bottoms of ravines where there is an abundance of shade and plenty of warmth and dampness. The common field mushroom and a few others are exceptions to this rule, for they grow best in open grassy meadows, fully exposed to the sun.

Mushrooms spring up with amazing rapidity during warm muggy summer nights, and reach their full growth, shed their spores, and decay in a very short time. They are very delicate plants, as a rule, being easily torn and crushed. They consist chiefly of water, so you can see why most of them cannot bear hot dry winds, or the rays of the summer sun. When a mushroom dies it usually decays into a slimy mass, filled with a multitude of little grubs, or larvae, the young of certain insects which lay their eggs in it.

We are all familiar with the common field mushroom either from seeing it in the fields, or perhaps only in cans or baskets in our markets. It is a rather stocky solid form, white with pinkish brown gills. It grows most abundantly in cow pastures, though it also

FUNGI DANGER SIGNALS

Avoid fungi when in the button or unexpanded stage, also those in which the flesh has begun to decay, even if only slightly. Avoid all fungi which have stalks with a swollen base surrounded by a sac-like or scaly envelope, especially if the gills are white. Avoid all fungi having a milky juice, unless the milk is reddish. Avoid fungi in which the cup or pileus is thin in proportion to the gills, and in which the gills are nearly all of equal length, especially if the pileus is bright-colored. Avoid all tube-bearing fungi in which the flesh changes color when cut or broken or where the mouths of the tubes are reddish; and in case of other tube-bearing fungi experiment with caution. Fungi which have a sort of spider-web or flocculent ring around the upper part of the stalk should in general be avoided.—Prof. William Gilson Farlow, of Harvard University.

A CONVENTION OF THE MUSHROOMS

At the magic summons of the artist's brush, twelve of the most prominent citizens of the land of mushrooms have been summoned to meet us in the woods. All of those shown are edible except the deadly Fly Mushroom (Amanita muscaria) (9), so called because of its property of killing flies. It exhibits many colors, among others, blood red as here shown, bay brown, orange, lemon, and white. Of the Coral Clavaria (Clavaria coralloides) (4), and the Parchment Lactarius (Lactarius pergamenus) (8), it should be said that while they are edible when perfect, they are slightly poisonous when imperfect and should be dealt with only by experts. The other mushrooms are: Shaggy Pholiota (Pholiota squarrosa) (1), Puff Ball (Lycoperdon bovista) (2), Dog Cortinarius (Cortinarius caninus) (3), Red Clavaria (Clavaria rufescens) (5), Violet Clavaria (Clavaria amethystina) (6), Meadow Mushroom (Agaricus campestris) (7), Common Morel (Morchella esculenta) (10), Magpie Mushroom (Coprinus picaceus) (11), Yellow Chanterelle (Cantharellus cibarius) (12). Of course the Puff Ball and the Morel are not, strictly speaking, mushrooms, but being close fungi relatives, have been invited to the convention.

does well in cellars. Many people make a business of mushroom raising, especially in Europe where fungi are eaten much more commonly than in this country. Enormous quantities are raised in Paris in underground galleries which extend for many miles at a depth of 60 to 160 feet below the surface.

After the field mushroom, the most common edible forms are the *puffballs*. These are large round whitish knobs, often seen growing along streams and roadways and in open pastures. They are filled with a soft white firm flesh, which turns into a mass of fibers and dark brown spores when the plant is ripe. Who has not stamped on a ripe puffball and watched the clouds of tiny spores rise from it like smoke? All the puffballs are edible when young, but you must be careful to gather them only when they are large, as some poisonous forms of umbrella-like mushrooms pass through a ball-like stage when young. Though all the puffballs are edible, not all are pleasant to the taste. The black puffball, which is hard like a potato and whose flesh is a glistening black, is very bitter, though not harmful.

TWO FINE MORELS

Morels such as these are among the most delicious of the edible fungi. They can be recognized by their pale yellow, buff, or green caps, ribbed and pitted like honeycombs.

Another group of edible fungi is the clavarias, or coral fungi. These grow up in finger-like masses in pretty hues of delicate pink, white, and yellow. The white varieties are the best for food. The clavarias grow only in deep, dark, damp woodlands, and wilt very easily when brought out into the sun. They look just like beautiful bunches of coral shining out among the dark forest trees.

The morel, which is one of the choicest of the fungi (though it is not a true mushroom), is easily recognized by its pale yellow, buff, or light green conical cap, ribbed and pitted like a honeycomb, and set on a stout whitish stem. Another prized mushroom is the chanterrelle, distinguishable by the deep rich yellow of its cap, which has an irregular crumpled margin. Its odor suggests ripe apricots or plums. The cap is usually depressed at the center, which gives the name "chanterrelle," meaning "little cup."

There are many other kinds of edible mushrooms—such as the edible pore mushroom, variable mushroom, oyster mushroom, horse mushroom, and the liver fungus—but it is not wise to try them for food except on the advice of some experienced person.

Let us turn now to examine some of the poisonous kinds. Two very deadly species are common in the United States—the amanita and the fly mushroom or fly amanita. The former is as beautiful a plant as one could wish to see. It lifts its delicate glistening white umbrella from the forest floor upon a slender graceful stem. But like the beautiful Lorelei in the old German legend, it lures one to destruction! For its beautiful body contains a substance so poisonous that it will cause death in a short time. Hence it is sometimes called the "destroying angel." Its poison is said to be chemically very much like that of the rattlesnake. The fly amanita is not so tall or slender, but it is scarcely less beautiful than its deadly sister. The top of the cap is a brilliant red, flecked all over with tiny white shining scales, like snowflakes, while the rest of the plant is pure white. It gets its name from the fact that its poison, extracted by steeping in milk, was used to kill flies. The poisonous substance in the amanitas and many other fungi is called "muscarine."

There are several other kinds of poisonous mushrooms. It is a wise rule not to eat any except those of which you are absolutely sure, and these only when they are perfectly fresh. Only one-tenth by weight of a mushroom is food, so it doesn't pay to take the chance of death for the sake of the little nourishment it contains.

Mushrooms and puffballs belong to the group of fungi (*see* Fungi) known as *Basidiomycetes*, which includes also the rusts and smuts. Scientific name of common field mushroom, *Agaricus campestris*. The morel belongs to the *Ascomycetes* group, and is closely related to the mildews and yeasts. In the same group is the delicious truffle, a tuberlike fungus which in many parts of Europe grows in groups a foot or so below the soil. Dogs and pigs are very fond of truffles and are trained to hunt them by scent.

The ANCIENT ART *of* ORPHEUS

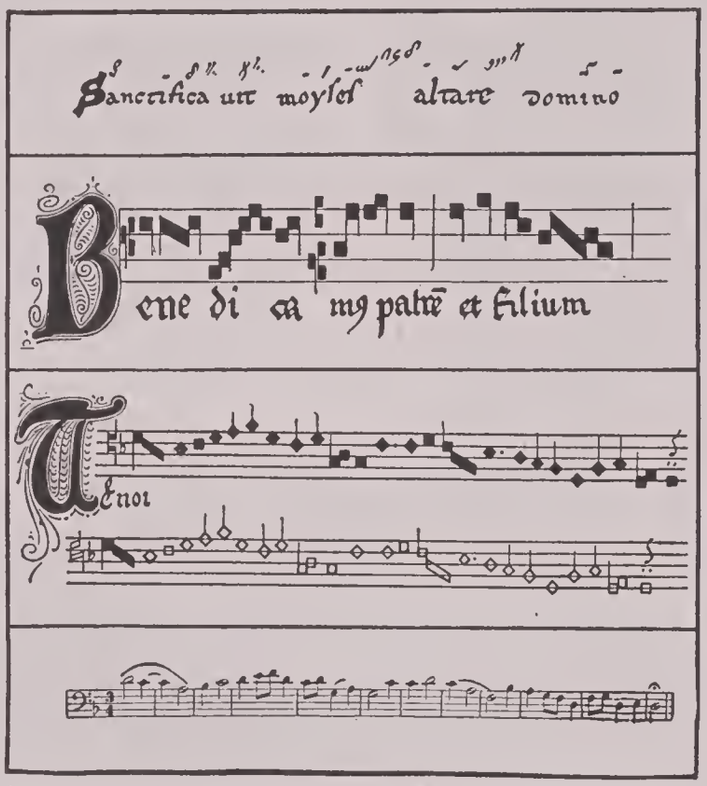
The World's Earliest Musicians—Music Before the Days of Notes—How the Monk Guido Became the Father of Music—When the Modern Period Began—The Great Composers and Their Work

MUSIC. It has well been said that "Music washes away from the soul the dust of everyday life." The story of music begins with the story of the human family. Some of the very oldest fables that we have tell us of the power of music. We know that before ever musical instruments were made there must have been chants or songs. And yet, from the days when men heard answering voices in the hills and caverns, there are legends that tell of instruments so sweet that their music charmed both men and beasts.

It is said that the ancient Greek hero Orpheus charmed not only the beasts but the very trees and stones with the music of his lyre; and a Chinese musician, who is supposed to have lived a thousand years before Orpheus, said, "When I play upon my *kin* the animals range themselves before me spell-bound with melody."

What were these instruments, and where did men get them? There is an old story of the wood-nymph Syrinx, who, frightened by the god Pan, called to the water-nymphs to protect her; and of how these nymphs changed her into a lovely water-reed that whispered as the winds blew over her. Pan, hearing her voice, lifted a handful of the reeds to his lips, and then, no longer hearing her voice, he sighed; when lo! the breath of his sigh on the hollow reeds made music! This, according to the Greeks, was the origin of their instrument called the "syrinx" or "pipes of Pan," made of hollow tubes or reeds bound together, and which were made to sound by the breath of the player.

LEARNING TO WRITE MUSIC



It took men thousands of years to learn to write music in the simple and intelligible modern fashion. As early as the 6th century of our era musicians had begun to indicate musical sounds by a complicated system of dashes, curves, hooks, and dots, as you see in the example at the top. By the 12th century they had introduced a four-line staff with square notes, thus indicating the intervals between the sounds. From the 15th to the 17th centuries, square and lozenge-shaped notes with or without "tails" to indicate time values were used, with a five-line staff and key signatures, as in the third and fourth examples. From this it was a short step to the present system, with time divisions shown by bars at right angles to the staff.

Music among the Hebrew People

We read in the first chapters of the Bible that Jubal was the "father of all those that handle the harp and the organ." In the temple of King Solomon, which was built almost a thousand years before the birth of Christ, we are told that there were thousands of priests, with trumpets and harps and psalteries, and that there were singers who sang beside the altar to the harps and other instruments. No written music has been found from these early times, and historians have decided that it must have been taught without notes or books, that is, by rote, one person singing or playing the music over and over until the hearers memorized it.

The Psalms of the Bible are the words of Hebrew songs. How we would like to hear the tunes to which those words were sung! When you have been reading a Psalm have you ever wondered what was meant by the word *selah?* Historians tell us the Psalms were sung by two great choirs, one on either side of the temple. One choir sang the first line; the other choir answered with the next line, thus:

First Choir: The earth is the Lord's and the fullness thereof;
Second Choir: The world and they that dwell therein.
First Choir: For he hath founded it upon the seas,
Second Choir: And established it upon the floods.

And so they continued through the Psalm until the word *selah* occurred; then the singers paused and the instruments played an interlude alone, after which the singing was resumed. In case there was but one choir, the opening and alternating lines were given by the priest and the choir responded. This method of singing is still used occasionally and is known as "antiphonal" singing.

Music among the Greeks

The Greek people were the first to leave any sort of written music, and what they left was very crude. They used the letters of their alphabet to represent musical tones. These they placed above the words of the poems which they sang. But this only served to give, in a very poor way, the pitch of the tone, and in no manner expressed the length of time it was to be sounded. The Greek people used music in their

For any subject not found in its alphabetical place see information

theaters as the Hebrew people used it in their temples. Naturally the music was different. They used both wind and stringed instruments and there are pictures which show the chorus dancing, and playing their instruments as they sang.

Music as we know it began with the Christian era, though we really have very little knowledge of it during the first 400 years of this period. It was about the year 350 A.D. that the first singing schools were established, for the purpose of training singers for the church services. In ancient times the congregation sang with the choirs, but the singing came to be so badly done that the council of Laodicea, in the year 367 A.D., decided to allow only trained singers to take part. The songs they used would sound very strange to our ears, for all sang the same melody in unison. There was no alto, or bass, or tenor. More than this, the songs were mostly chants, which means that several words were sung, half spoken, to one tone. A step in advance was taken by Pope Gregory the Great (590–604 A.D.), who revised the music of the church services and introduced what is still called the "Gregorian Chant." All chants or songs had to be taught by rote, because even then there was no satisfactory way invented to write music.

At last, a young monk named Guido, of Arezzo, Italy, became much dissatisfied with this slow process. In a letter written in 1020 A.D. he complained: "When the little boys have finally learned to read the psalter, they can read all other books. Whoever has once trimmed a vine or tree will be able to do it again as well or even better. These wonderful singing teachers, however, and their scholars may sing every day for a hundred years, and yet not be able to sing the response without instruction. In the church service it often sounds, not as if we were praising God, but rather as if we were quarreling among ourselves."

PALESTRINA, MASTER OF THE MASS

This is Giovanni da Palestrina composing a mass. Pope Pius IV compared one of his masses to the music heard by St. John in his vision of the New Jerusalem and as a result Palestrina was appointed composer to the Sistine Chapel. Palestrina's greatest composition, the 'Missa Papae Marcelli', named in honor of Pope Marcellus II, is still a favorite in the service of the Sistine Chapel at Rome.

But this young monk not only complained; he at once set out to remedy the trouble, with such success that he has been called the "father of music." He used the musical staff much as we have it now, and also our system of singing by syllables. The idea of singing by syllables came to Guido in this way. A certain Latin hymn, then much in use, whose first six lines began respectively on the first six tones of the scale, suggested to him that if the pupils learned this song and remembered how to pitch the first tone of each line, they would then know the pitch of that tone wherever they saw it. The lines began with Latin words, the first syllables of which were: *Ut* (afterward changed to *Do*), *Re, Mi, Fa, Sol, La.* The fact that *sol-fa* singing, with these same syllables, is still in use today proves the soundness of his theory. Of course this idea would not have worked had the staff not already been invented on which to write the syllables. The next step was to invent some way of showing the relative length of the tones. Gradually block notes of different shapes were worked out with a dot or a hook to mark the accented note.

At first all music was sung in triple or three-pulse time, with one strong and two weak beats to each group. Later double time, with one strong and one weak beat to each group, was used. Then bar lines were drawn across the staff before each strong or accented note. The notes were also made round instead of square, and written music began to look as we see it now.

Although the music of the church was now set down in writing, there was still much valuable music of which we have no written record. The common folk had their own songs and dances, and bards and minstrels wandered from court to court, always

welcome because of the music they made. Even during war, the bards were welcome in enemy camps, so esteemed was the art of minstrelsy. There is a well known story telling how King Alfred the Great disguised himself as a minstrel and entered the camp of the Danes as a spy on the eve of a great battle. What, we wonder, did he sing? Very few of the old folk-songs of this far-off time have come to us, and these are so changed, from having been passed down for generations, that we can hardly consider them representative in their present form.

JOHN SEBASTIAN BACH
The "Master of Masters"

About the 12th century secular music — that is, music that is not religious — began to be very popular. In southern France, the troubadours composed and sang songs of their lady-loves; in Germany, the minnesingers composed similar songs as well as songs of chivalry, patriotism, and nature, which they sang to the accompaniment of the harp. Other German singers formed themselves into a gild called the "master singers" (*die Meistersinger*). In this gild rewards were given for excellence in musical composition submitted at an annual contest. In these ways, not only vocal but also instrumental music was stimulated. Many new instruments were used and old ones were improved.

The Three Elements of Music

Music is made up of three elements—melody, rhythm, and harmony. Up to this time, only two elements, melody and rhythm, had been developed. Another hundred years passed before the third element, harmony, was added. This third element was at first called "counterpoint." This name was given because the notes of the melody written on the staff were called "points"; and now, in addition to these points, a second melody of points was written, point for point, for the two melodies were to be sung at the same time. As the choirs became able to master the two-voiced songs, third, fourth, and fifth melodies were added giving rise to what is called the polyphonic ("many voiced") form. In what is known as the Flemish school of composers (1400 to 1600) music reached a higher point than it had ever before attained. The "Venetian School" of musicians (1527–1612) saw that the different voices in "counter point" really combined to form a succession of chords, and launched the idea we find running through modern music—that of chords enriching the principal melody and also carrying one or more subordinate melodies.

With these new developments musicians of the Catholic church began to create really beautiful music for their formal services. The mass was a favorite form of composition. One outstanding name in this connection is that of the Italian composer Palestrina (1524–1594). He was a peasant by birth and was educated at Rome under a teacher from the famous Flemish school of music. He not only became the greatest organist of his time, but wrote masses which are as yet unsurpassed. It was of one of his masses that Pope Marcellus II said: "These are the harmonies of the 'new song' which the Apostle John heard out of the heavenly Jerusalem." Along with the music of the Catholic church, the music of the Reformed, or Protestant, church developed. Luther himself wrote many beautiful hymns.

With these new interests in vocal music, instrumental music had become very popular. The organs were so improved that the greatest musicians of the time composed for them. Other instruments with keyboards were invented, and these greatly helped the musicians who were just beginning to put two and three tones together into what we call chords, and so to develop harmony as we know it today. The violin was perfected about this time and violin solos were greatly in demand. An instrumental solo was called a "sonata" (sound piece) to distinguish it from vocal music, which was called a "cantata" (singing piece). Most important of all, about this time (1500) movable types for printing music were invented.

The Beginning of Modern Music

What is spoken of as modern music begins shortly before the year 1600. About this time the first opera was given in Florence, and the first oratorio in Rome (*see* Opera). The orchestra in something like its modern form was also developed (*see* Orchestra).

During the next two hundred years, music developed very rapidly, and to this period belong some of the greatest masters of the art the world has ever known. John Sebastian Bach, who lived during this time, lives again in the concert programs of today. George Frederick Handel, whose 'Messiah' is a part of our yearly Christmas festival, belongs to these years, as do also Haydn, Glück, and the delightful Mozart. During this time, too, the piano was invented and the orchestra became popular.

GEORGE FREDERICK HANDEL
King of Oratorio

The great masters of this period established the chief musical forms as we know them today. The "suite" was a name given to a set of old-time dances; as a musical form it came to mean a group of movements in the same key and for the most part main-

taining dance rhythms. The "sonata," the most elaborate of all musical forms, was particularly the work of Haydn. It usually has three or four movements, or divisions, all closely related and obeying certain rules. The first movement is usually an *allegro*, or lively movement, constructed in the strict "sonata form," containing an "exposition" or statement of the subjects, a "development" or working out of the subjects, and a "recapitulation." The second movement is usually an *adagio, largo, andante* or other slow movement. Next comes a lighter movement —a *minuet* or *scherzo* — followed by a quick *finale*, often in *rondo* form. The term "sonata" is restricted to a composition for one or two instruments. The *concerto* is a sonata for a solo instrument and the orchestra; the *symphony* is a sonata for an orchestra.

WOLFGANG AMADEUS MOZART
Supreme for Melodic Grace

While these things were taking place in Europe, America was beginning its national history and developing its music. You remember that the Pilgrims, who landed in 1620, came to America for the sake of religious freedom. Therefore all their lives for many years centered about the church. They had brought with them the "Psalm Book" used in the Reformed churches in Europe, but alas! they only knew about five of the tunes, and these they used over and over for the different Psalms. Then came the 'Bay Psalm Book', the first musical publication in America.

WILHELM RICHARD WAGNER
Father of the Modern Music Drama

Have you heard your grandfather tell how, in the old days, the deacon or minister "lined out" the hymns? In colonial days it was sometimes called "deaconing." The deacon read the first line, then the congregation sang it; he then read the second line and the congregation sang that, and so on. Sometimes this worked havoc with the sense of the text. For example, in Hood's 'History of Music in New England' we find this story. The deacon was lining out the Psalm which says, "The Lord will come, and he will not keep silence, but speak out." "The Lord will come and he will not," read the deacon, and the congregation faithfully sang the line. Then came "Keep silence, but speak out"—which must have caused even our grave forefathers to smile!

The introduction of the new song book, with notes written in next to the words, caused a stormy quarrel among the membership. Here are a few of the directions for using the new book. "Observe how many notes' compass the tune is. Next, the place of your first note; and how many notes above and below that, so as you may begin the tune of your first note, as the rest may be sung in the compass of your and the people's voices, without squeaking above or grumbling below." Some of the written objections offered to the use of the 'Bay Psalm Book' were these: "First, it is a new way — an unknown tongue. Second, it is not so melodious as the old way. Third, there are so many tunes that nobody can ever learn them. Fourth, the new way makes disturbance in churches, grieves good men, exasperates them, and causes them to behave disorderly. Fifth, it is popish. Sixth, it will introduce instruments. Seventh, the names of the notes are blashpemous. Eighth, it is needless, the old way being good enough. Ninth, it requires too much time to learn it. Tenth, it makes the young disorderly."

LUDWIG VAN BEETHOVEN
The Shakespeare of Music

But while the minister, the deacon, and the congregation disputed, an outside influence arose that had much to do with the progress of music in the churches. In Boston, the first singing society was organized to "practice singing by note." Soon singing schools followed in other settlements, and it was not long before improvement was noticeable in the church singing.

It is recorded that in the year 1762 one parish voted that "those who have learned the art of singing may have liberty to sit in the front gallery." However, it seems that those who had thus improved themselves objected to the old method of deaconing that was still in vogue, and did not avail themselves of the privilege of the gallery! From a record of 20 years later we read, "The Parish desires the singers, both male and female, to sit in the gallery, and will allow them to sing once upon each Lord's day without reading by the deacon."

Another quarrel arose over the use of the organ in the Puritan church service. A member of a Puritan church in Boston presented an organ to his

church. The instructions accompanying the gift were, that "the society procure a sober person to play skilfully thereon with a loud noise." But the society refused the gift, replying, "We do not think it proper in the public worship of God." So the organ was given to the King's Chapel, which was not Puritan, and was the first pipe organ set up in a New England church. And it was not until 80 years later that the membership of the church which refused the gift could agree that an organ was permissible.

Secular music also developed through the singing-schools. Collections of secular songs began to be published and were advertised to contain songs by American composers. To be sure, we cannot claim too much for these first American songs, but at least a beginning had been made. From this time on music in the United States developed rapidly. Boston was for years the musical center of America. There, early in the 19th century, the oratorios of Handel were played, an orchestra of 50 pieces was organized, and the Academy of Music was founded.

THE "WORK BENCH" OF A GREAT COMPOSER

This is the harpsichord on which Handel worked out many of his most famous oratorios. In Handel's day the piano had not yet come into general use. The great composer got his early training on another instrument of the same family, the clavichord, whose tones are so soft as to be inaudible behind closed doors. This served young Handel well, for his father objected to music as a means of livelihood, so the boy practiced on a clavichord in the attic.

New York produced opera for the first time in America, and with Philadelphia soon followed Boston in organizing an orchestra. The earliest years of the 20th century found large and very fine orchestras in all the leading cities, found American songs in use the world around, and found at least one composer, Edward MacDowell, whose compositions give him rank with the foremost musicians of modern times.

In Europe, the 19th century gave to the world the two men whose names stand for the highest development of instrumental and dramatic music. The sonatas and symphonies of Beethoven are as yet not only unsurpassed but in some respects unequaled. The same may be said of the operas of Wagner, who so expanded the dramatic and harmonic resources of music that his influence may be traced in the work of all composers since his time. The 19th century is also remarkable for the development of the lyric to a finished art-form, in the hands of the great Schumann and Schubert, both supreme masters of song.

The closing years of the century were marked by a development toward greater freedom of expression and increased complexity of structure, which still remains as the outstanding characteristic of present-day music. This tendency toward "musical impressionism" is seen at its fullest in the work of such men as Debussy in France, Richard Strauss in Austria and Germany, Edvard Grieg in Norway, and Tschaikovsky in Russia. Pushing forward along the path marked out by Wagner, these and other great composers of the 20th century have so enriched and enlarged the resources of music that it has come to be not only the most universal of the arts, but the art through which the emotions of all kinds and conditions of men may find expression. And the development of mechanical means of reproducing music — such as the phonograph, the player-piano and the like—have made possible its appreciation and study as never before in the world, so that the best of the noble art may be heard and enjoyed by the humblest, in the remotest village in the land.

Some of the outstanding names in the history of music, with the types of composition for which they are chiefly remembered and the names of some of their most famous works, are as follows:

Bach, Johann Sebastian (1685–1750). German. Organ and piano works ('Passion Music', 'Well-Tempered Clavichord').

Beethoven, Ludwig van (1770–1827). German. Sonatas, symphonies, operas ('Pathétique', 'Moonlight', and 'Kreutzer' sonatas; 'Eroica' and 'Pastoral' symphonies; 'Egmont', 'Fidelio').

Berlioz, Hector (1803–1869). French. Operas ('Damnation de Faust', 'Romeo et Juliette').

Bizet, Georges (1838–1875). French. Operas ('Carmen', 'Les Pêcheurs de Perles').

Brahms, Johannes (1833–1897). German. Songs, symphonies, concertos ('Requiem', 'Cradle Song').

Buck, Dudley (1839–1909). American. Sacred songs, anthems, cantatas, operas ('Golden Legend').

Chadwick, George Whitefield (1854–). American. Choral works, symphonies, overtures ('Melpomene Overture').

Charpentier, Gustave (1869–). French. Operas ('Louise', 'Orphée').

Chopin, Frédéric François (1810–1849). French-Polish. Sonatas, concertos, waltzes, etc., for piano ('Funeral March', 'Nocturnes', 'Preludes', etc.).
Debussy, Claude Achille (1862–1918). French. Operas, piano and orchestral works ('La Mer', 'Pelléas et Mélisande').
DeKoven, Reginald (1861–1920). American. Songs, comic operas ('Robin Hood', 'Maid Marian').
Donizetti, Gaetano (1797–1848). Italian. Operas ('Lucia di Lammermoor').
Dvorák, Antonin (1841–1904). Bohemian. Choral works, symphonies ('New World Symphony', 'Stabat Mater', 'Humoresque').
Elgar, Sir Edward (1857–). English. Oratorios, orchestral pieces ('Dream of Gerontius').
Franck, César (1822-1890). French. Oratorios, symphonies, chamber music.
Franz, Robert (1815–1892). German. Songs ('Es hat die Rose sich beklagt').
Glück, Christoph Willibald (1714–1787). German. Operas ('Iphigénie en Tauride').
Gounod, Charles François (1818–1893). French. Sacred works, operas ('Faust').
Grieg, Edvard Hagerup (1843–1907). Norwegian. Songs, short pieces for orchestra and piano ('Peer Gynt Suite').
Handel, George Frederick (1685–1759). German. Oratorios, operas ('Messiah', 'Samson').
Haydn, Franz Joseph (1732–1809). Austrian. Symphonies, operas, oratorios ('The Creation', 'The Seasons').
Herbert, Victor (1859–). American. Comic operas ('The Serenade', 'Babes in Toyland').
Humperdinck, Engelbert (1854–1921). German. Operas ('Hänsel und Gretel').
Liszt, Franz (1811–1886). Hungarian. Piano pieces, songs, orchestral works ('Dante' and 'Faust' symphonies).
MacDowell, Edward Alexander (1861–1908). American. Songs, piano pieces, orchestral works ('Woodland Sketches', 'Sea Pieces').
Mascagni, Pietro (1863–). Italian. Operas ('Cavalleria Rusticana').
Massenet, Jules Émile Frédéric (1842–1912). French. Songs, operas, orchestral works ('Thäis', 'Le Jongleur de Nôtre Dame').
Mendelssohn-Bartholdy, Felix (1809–1847). German. Oratorios, symphonies, piano pieces ('Songs Without Words', 'St. Paul', 'Elijah').
Moszkowski, Moritz (1854–). Polish. Overtures, concert suites, etc., for piano ('Spanish Dances').
Mozart, Wolfgang Amadeus (1756–1791). Austrian. Operas, orchestral works, sacred compositions ('The Marriage of Figaro', 'The Magic Flute').
Palestrina, Giovanni Pierluigi da (1526?–1594). Italian. Sacred works.
Parker, Horatio William (1863–1919). American. Oratorios, anthems, sacred songs.
Puccini, Giacomo (1858–). Italian. Operas ('Tosca', 'Madame Butterfly', 'La Bohême').
Rachmaninof, Sergei (1873–). Russian. Piano pieces, symphonies, concertos ('Prelude in C Sharp Minor').
Rimsky-Korsakof, Nicholas Andreievich (1844–1908). Russian. Symphonies and other orchestral pieces ('Le Coq d' Or', 'Scheherezade').
Rossini, Gioacchino Antonio (1792–1868). Italian. Operas ('William Tell', 'The Barber of Seville').
Rubinstein, Anton Gregor (1829–1894). Russian. Piano pieces, songs, concertos, symphonies ('Der Asra', 'Eroica Fantasia').
Saint-Saëns, Charles Camille (1835–). French. Operas, orchestral works ('Samson et Delilah').
Schubert, Franz Peter (1797–1828). German. Songs, symphonies, chamber music ('The Erlking', 'Unfinished' symphony).
Schumann, Robert (1810–1856). German. Songs, piano pieces, orchestral works ('Carnival', 'Dichterliebe', 'The Two Grenadiers').
Strauss, Richard (1864–). German. Operas ('Salome').
Sullivan, Sir Arthur Seymour (1842–1900). English. Comic operas, songs, church music ('The Mikado', 'Pirates of Penzance', 'Patience').
Tschaikovsky, Peter Ilitch (1840–1893). Russian. Symphonies, songs, concertos ('Manfred' and 'Pathétique' symphonies, 'Francesca da Rimini').
Verdi, Giuseppe (1813–1901). Italian. Operas ('Rigoletto', 'Il Trovatore', 'La Traviata', 'Aida').
Wagner, Wilhelm Richard (1813–1883). German. Operas ('Lohengrin', 'Tannhäuser', 'Tristan und Isolde', 'Parsifal').

MUSICAL INSTRUMENTS. If you stretch a string or wire tightly and pluck it, the string vibrates and makes a pleasing sound. Or if you close one end of a hollow tube and blow into the other, the air in the tube is set vibrating and makes a different sort of sound. Again, if you strike a thin piece of leather stretched over a box, or a piece of metal suspended by a string, you get another kind of sound caused by the vibration of the leather or the metal.

From these three modes of causing sounds come all the various kinds of musical instruments. When you first look at the piano, the organ, and the many instruments used in bands or orchestras, they seem very different from each other. But a little observation will show you that they all fall into these three great groups or families, according to the way they produce their sounds. Those in which the sound comes from vibrating strings are known as *stringed* instruments; those in which a column of air is set in motion are called *wind* instruments; those which themselves are set vibrating by being struck are called *percussion* instruments.

Of these families the string group is the largest. The piano is its best-known member (*see* Piano). Open the case and you find the strings. They are of wire and are stretched across a great sounding board of fine strong wood that will not crack or warp. Now, with a quick touch press one of the keys in the center of the keyboard. You will see that you cause a little felt hammer to lift away from the string and at the same time a little metal hammer to strike the string. When this is taking place, you hear a tone. Now take your finger from the key, and you will see the little felt hammer fall back against the string; at once the tone is hushed. This is because the felt pressing against the string stops the vibrations. Sound a key well down toward the left-hand end of the keyboard; the tone you will hear is much deeper. This is because the bass strings are so much heavier and longer that they vibrate more slowly and the tone that reaches your ear is duller.

The harp has almost as many strings as the piano, but all except those in the bass are made of catgut, and instead of being struck they are plucked with the fingers. Most of the harp tones are thus made without vibrations of any metal, and are therefore much sweeter and richer than the tones of the piano. When you hear a harp you will recall the story about the boy David, who thousands of years ago played upon his harp to soothe the suffering king. For the harp is one of the oldest of all instruments. Read

PAN'S PIPES AND THEIR CHILDREN

If Pan really did play those wild pipes of his and so make them the father of all musical instruments, see what an incredible variety came of it and how those pipes reappeared again in the great pipe organ (32) of today. The other musical instruments are: Fife (1), Flute (2), Clarinet (3), Oboe (4), Violin (5), Violoncello (6), Double Bass (7), Ancient Trumpet (8), Castanets (9), Lyre (10), Cymbals (early) (11), Ancient Harp (12), Bugle (13), Modern Trumpet (14), Cornet (15), Tambourine (16), Trombone (17), Saxophone (18), Bagpipe (19), Bass Horn (20), Triangle (21), Helicon (22), Harp (23), Guitar (24), Mandolin (25), Ocarina (26), Kettle Drum (27), Snare Drum (28), Bass Drum (29), Zither (30), Piano (31), Accordion (33), Harmonium (36). The Tuning Fork (34) and Metronome (35) are used to get true pitch and to mark time. The four instruments in the upper left-hand corner belong to the "woodwind" group, while the horns to the right are members of the "brass" group.

For any subject not found in its alphabetical place see information

its story, how it has sung its way from a bow-string to the proudest place in the concert hall (*see* Harp).

Other stringed instruments played much like the harp are the guitar, the mandolin, the banjo, and the zither (*see* Banjo; Guitar; Mandolin).

The violin, another very important member of the string family, is played in a different manner. Instead of being plucked or struck, its strings are usually set vibrating by drawing a horse-hair bow across them, though occasionally harplike effects are obtained from it by plucking. Closely related to the violin are the viola, violoncello, and double bass, which are larger forms of the same type, producing deeper sounds by reason of their size (*see* Violin).

Now we come to the great family of wind instruments. The flute, probably the most ancient of all musical instruments, is the typical member. This is simply a closed tube in which the air is set in vibration by blowing into it through a mouthpiece or through a hole in the side. A smaller form of the flute with a shriller sound is called the piccolo.

After the invention of the flute, men discovered that they could get different and more varied effects by using a longer tube with a mouthpiece against which their lips could vibrate. Thus originated the wind instruments of the horn and trumpet type. Very long tubes are required to produce a deep tone, and so in most instruments of this kind the long tube is curved into a more or less circular form. In one type, the trombone, the tube is made in two parts, one fitting into the other, so that it can be drawn in or out and thus made shorter or longer. The familiar cornet and the great bass tuba are also members of this group, which is known to musicians as the "brasses" (*see* Horn, Musical).

There is another group of wind instruments known as the "reeds," because they have reeds in their mouthpieces. These reeds are set in rapid vibration by the breath, and they in turn start the air vibrating in the tube, thus producing the sound. Among the common reed instruments are the oboe, English horn, bassoon, clarinet, and saxophone.

Now we come to the percussion instruments, those that themselves vibrate when struck. They are of two chief kinds, drums and bells. Everyone knows the big bass drum and the smaller snare drum, which are so much used in bands to mark the time and to produce rumbling martial effects. These drums produce indefinite sounds of no fixed pitch, but there is another kind, the kettledrum, which can be tuned to a definite pitch and is much used in orchestras (*see* Drum). In the bell group are such instruments as the triangle, the glockenspiel, the xylophone, the celesta, and the cymbals.

The great pipe organ and the smaller cabinet or reed organ are merely improved wind instruments. In these the air supply is fed by means of bellows instead of the player's breath, and a great number of pipes or freely vibrating reeds is brought under control by means of one or more keyboards (*see* Organ).

In addition to these more important musical instruments, there are a great many minor instruments. Among these are the *accordion*, which is made on the principle of the bellows, the sound being produced by forcing air through metallic reeds; the *bagpipe*, in which the player forces air through three or more pipes by pressure of his arm on a leather wind-bag kept supplied from his lungs; the *jew's harp*, a small lyre-shaped instrument, which, placed between the teeth, gives tones from a bent metal tongue struck by the finger; the *harmonica* or *mouth organ* (sometimes called the French harp), in which the notes are produced by the vibration of free metallic reeds; and the *ocarina*, a little instrument which has an ovoid body, usually of terra-cotta, with a mouthpiece and finger holes by means of which soft whistle-like tones are produced.

Since each musical instrument has its characteristic "timbre" (quality of tone) and strength of note, composers have a tremendous variety of musical effects which they can use in expressing their ideas. (For explanation of the difference in quality between instruments, *see* Sound.) Even the existing variety, however, is not enough, and many composers have invented special instruments to produce particular effects for certain compositions.

MUSK DEER. From very early times this animal has been hunted for the sweet-smelling "musk" which it yields. It differs from other members of the deer family in having no antlers in either male or female. The male, however, has sharp tusks projecting downward from the upper jaw which are used in fighting. Musk deer inhabit the high plateaus of Central Asia, usually living alone, rarely in pairs, and never in herds. They are shy, feeding mainly at night, and on account of the difficulty of approaching them they are usually caught in traps. A full-grown specimen is about three feet long and 20 inches high at the shoulders. They vary in color, but are commonly grayish or yellowish-brown, and whitish below. The musk is found in the male only, in a sac the size of a very small orange, situated on the under surface of the abdomen. The sac contains an ounce or more of the crude musk, which when fresh, is said to resemble moist gingerbread in color and consistency. Because of its powerful and enduring odor, this substance is of great value in making perfumery, and is an important article of commerce throughout Asia. Scientific name, *Moschus moschiferus*.

MUSK OX. In size and shape the musk ox resembles the ox; in habit it is like the sheep, and hence it is sometimes called also the musk sheep. It is very agile, swift, and sure of foot. It is now restricted to arctic America north of latitude 60°, but formerly it was more widely distributed and occurred in Europe as well as in America, where it once wandered as far south as Kentucky.

The musk ox is a strange looking creature, appearing to be a low mass of hair of great length and thickness, tangled at the shoulders. The legs are short and postlike; the head is massive; the tail very short; the horns meet in the middle of the forehead and curve downward and outward, with the tips pointing upward. The coat next the body is very fine and soft, of a light brown color; the outer hairs are coarser, darker, sometimes a foot long. The hairy coat is shed during hot weather. A full-grown male reaches

a weight of 450 pounds. The animal gets its name from its peculiar musky odor, which, however, does not appear to be due to the secretion of any particular gland, as in the case of the musk deer. Its cause is not known.

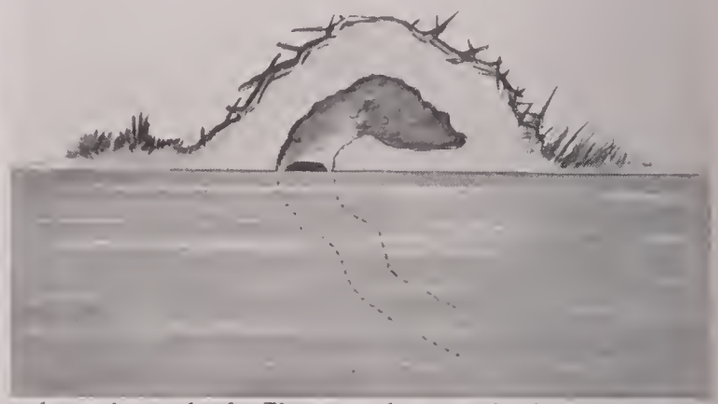
Musk oxen live in herds of 20 or 30 upward and feed on grasses, lichens, moss, willow, and pine shoots. The flesh of some is very palatable, of others tough and unpleasantly musky, especially in old males. They are important food animals to the Eskimos and to Arctic explorers. Scientific name, *Ovibos moschatus.*

THE MUSK OX AT HOME

Cold weather does not worry the Musk Ox with his hairy robe. So long as he finds lichens, moss, and willow and pine shoots peeping above the snow he nibbles them and keeps fat and happy.

Muskrat. Sometimes when you go skating on a frozen pond in the winter you find a dome-shaped mud-and-grass house, or a little village of a dozen such houses frozen in the ice and covered with snow. If you push a stick carefully through the thick wall, you can hear a soft skurrying inside, then a "plunk, plunk, plunk!" as the muskrats one after another plunge into the water, through a doorway giving access to the water below the ice.

THE MUSKRAT AND HIS HOUSE



On the left is one of these busy little creatures hunting about among the bushes on land. The water, however, is his favorite refuge and the element in which he spends much of his time. At the right is a sketch showing how his winter house would look if cut through the middle. Notice its underwater door.

The muskrat doesn't mind. You couldn't wet his sleek, brown fur coat any more than you could wet a duck's feathers. He sleeps only in the daytime, in winter. At night he tumbles out into the icy water and hunts for food. He lives on fresh-water mussels, the tender white calamus blades, and similar food. In summer he burrows in the bank or builds a nest under bushes on the swamp. John Burroughs said the muskrat sometimes seems to be a fine weather prophet. If he begins to build his winter house by October — and he works mostly at night—you may be sure there is to be a cold winter. If he builds very high and strong, his house solidly plastered to logs, stumps, or tussocks of grass, look out for high water. "But," said Mr. Burroughs, "I doubt if a long series of observations would bear out the truth of this."

A dark lantern, with which you can throw a light over a pond, will often give you glimpses of muskrat families feeding. The grown muskrats are about a foot long, rather heavily built, and are covered with thick fur of a glossy brown color. Muskrats sit up to eat, somewhat like kangaroos, using their six-inch flat scaly tails for third legs. They use those tails also for rudders in swimming and with them they slap the water to warn their companions of danger. For his size the muskrat is just as bright and clever as his big cousin, the beaver. Even where they are too quick for you and you fail to catch a glimpse of them, you can tell where muskrats have been by a faint musky odor, as of a flower perfume, on the frosty moonlit air of a lonely marsh.

The muskrat, which is also called "musquash," is a rodent, a member of the large family which includes

also the squirrel, the rabbit, and the beaver. It is found in all parts of North America, from Labrador to Alaska and south to Louisiana. Large numbers are killed annually, being either trapped or speared in the winter when their skins are of greatest commercial value. The fur is used in its natural state and is also dyed to resemble other furs. So-called "Hudson seal" is made by plucking out the long hairs of muskrat skins and dying the soft undercoat a seal color. The flesh of the muskrat is said to be palatable, and is esteemed as a dainty, not only by Indians but by others who have tasted it. Scientific name, *Fiber zibethicus*.

MUSTARD. Though mustard has been used both as a table condiment and as a medicine from remote times, we owe the idea of grinding the seeds of the mustard plant to a flour to Mrs. Clements, of Durham, England, who hit on the process in 1720. The pungent light yellow flour thereby produced under the name of "Durham Mustard" sprang into instant popularity, King George I giving it his royal approval.

The greater part of the mustard of commerce is prepared from two varieties of the mustard plant—one having white seed, the other black. The latter has the sharper flavor. The plant will grow almost anywhere, and is well known through the United States, especially in California and Kentucky where it is an important crop. The young plants of white mustard are often eaten as "greens" and in salads, and are also grown in England for forage.

The seeds, which are very tiny, some weighing not more than one-fiftieth of a grain, are cleaned and crushed between rollers, and the oil is extracted by pressure. After the cake is dried, it is ground and bolted to remove the husks. Wet or "prepared" mustard is made from crushed mustard seed, vinegar and spices. Mustard is used medicinally in plasters and as an emetic in poisoning.

There are about 100 species of mustard plants, belonging to the genus *Brassica*. They all have yellow four-petaled flowers, and pods containing one row of seeds. Strictly speaking, cabbage, kale, cauliflower, turnips, and some other vegetables are mustards. (*See* Cabbage.)

MYRTLE. The common myrtle, which among the ancient Greeks was sacred to Aphrodite as the symbol of youth and beauty and was much used in their festivals, is a beautiful evergreen shrub or small tree native to the countries of the Mediterranean. It is frequently mentioned in poetry and reference is made to it also in the Bible. It is not found in the United States except where cultivated. This classic myrtle (*Myrtus communis*), which grows from 6 to 20 feet high, has glossy leaves and fragrant white or rose-colored flowers, followed by pulpy black berries. Perfumery is made from the aromatic leaves and berries, and in some parts of southern Europe the bark is used in tanning leather.

The trailing myrtle which is common in gardens, cemeteries, and shaded parks, is an evergreen perennial showing many varieties. It is not a true myrtle but belongs to the periwinkle family. Its lovely blue flowers, which in the early spring make so welcome a sight amid the glossy green leaves, are succeeded by slender many-seeded follicles.

Scientific name of trailing myrtle, *Vinca minor*. Stem creeping, with only short flower stems, ascending; leaves opposite, evergreen, oblong; flowers solitary, growing in the axils of the leaves; salver-shaped corolla, with 5-lobed border; throat angled and thickened; 5 stamens.

MYTHOLOGY. "Where does the sun go at night?" "What are the clouds?" "Who is it makes the thunder?" These are some of the questions that the little child asks his mother, when he first begins to observe about him the wonderful world of nature. In the childhood of the human race men asked just such questions as these, and not having science to aid them they invented strange explanations.

To the ancient Greeks the sun was a golden-haired god driving a gleaming chariot across the heavens. The moon was his sister, a swift huntress armed with bow and arrow. And more powerful than either of these was the great god of the heavens who hurled the thunderbolt, who darkened the face of the earth with the storm cloud, who sent the rain to water the dry ground. All living things seemed to the primitive Greek to have personality, and the great forces of nature which he could not control were also beings like himself, but immeasurably stronger and immensely more powerful.

In the same way all other primitive peoples formed ideas of supernatural beings, or gods, and invented stories about them, which we call myths. Myths are like fairy tales in that they tell of impossible things; but unlike fairy tales, they were not told simply for amusement. For myths are stories which were at one time believed to be true.

Not only is mythology "science in its infancy," but it is also religion in its infancy. However unreasonable or absurd or even disgusting some of the myths of savage races may seem to us today, we must remember that the men who invented them were seeking, in their blind and groping way, for the truth. As someone has said, the myth is "the voice of a people calling on God."

It is an interesting and instructive fact that many of the myths found in lands far apart are remarkably alike. Not only are many of the Greek myths like those of India and of Egypt, but also those of the Norse countries, and even, in some cases, the myths of the American Indians. Both nature and men are very much the same the world over, and it is but natural that the first attempts to find answers to the riddles of the day and the night, the earth and the sky, the sun, moon, and stars, should have resulted in similar stories.

It is perhaps even more interesting to note how each race has stamped its own character upon its mythology. The mythology of the Greeks reflects their joy in life and love of beauty. The Norse mythology breathes a warlike spirit, and shows the

conflict with stern and rugged forces of nature. That of the Hindus is full of awe at the mysterious and sublime powers of nature. The mythologies of savages are almost unbelievably childish and absurd. Their gods are often represented as beasts. The Bushmen of Africa regard an insect as the highest of their supernatural beings. The Zulus worship their ancestors, which appear to men in the form of snakes, and they believe that thunder is caused by the thunder-bird. As men develop in civilization and culture, so do their ideas of the gods develop.

Tendency to Myth Making Even Today

Besides the beliefs still held by savages and by the less educated classes in such countries as Russia, Japan, India, and China, and besides the nursery stories—myths of Jack the Giant Killer, etc.—there is a constant tendency for myths to spring up in connection with great men such as Washington and Lincoln and events which appeal to our sense of the great and marvelous. Even in the year 1915 there were many who believed the wholly fictitious story of "the angels of Mons," a squadron of heavenly beings who according to many accounts appeared in one of the most terrible battles of the World War and gave victory to the British against the Germans. But the spread of science and the preservation of records together with the love of accuracy fostered by our historians, tend to prevent the formation of myths and to break down the belief in old ones.

Why then should we be interested in myths, and why do scholars devote their lives to studying and comparing the mythologies of the various peoples? In the first place, myths were a part of the very life of the people who made and believed them. To understand the ancient peoples, our own ancestors among the rest, we must know not only what they did, but what they believed. Mythology is therefore an important part of history, for the light it throws on early human thought and conduct.

Relation of Mythology to Literature

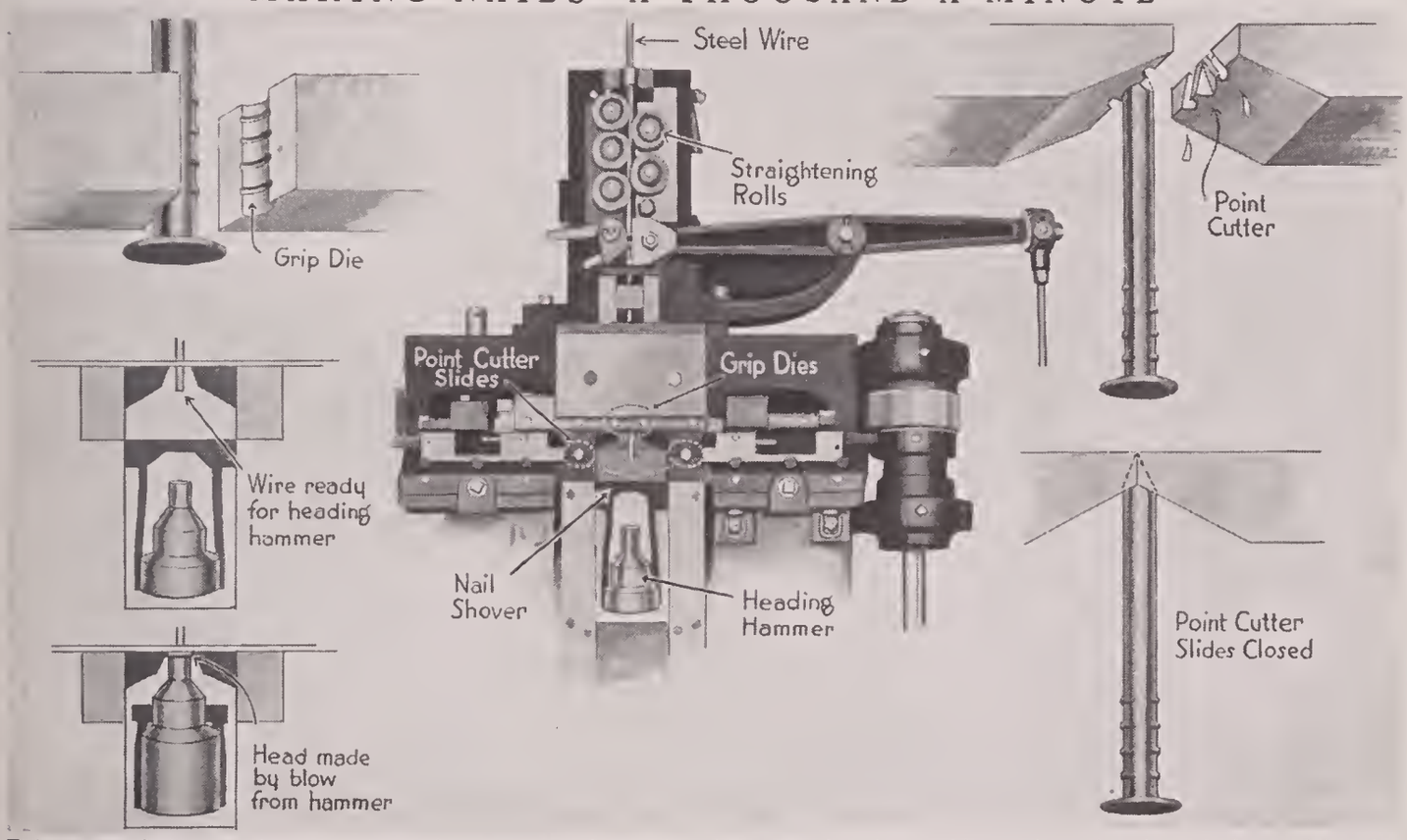
In the second place, mythology is also a part of literature, and we cannot understand the literature of the early peoples without knowing something about their mythology. Especially is this true of Greek and Roman literature, and what is most important of all for us—as this literature has had a profound influence upon that of today, so has the old mythology become interwoven with the very fabric of our literature. To understand a single page of Milton's 'Paradise Lost'; to fully appreciate the beauty of Shelley, Keats, or Byron, of Tennyson or Browning, one must be familiar with these old myths, for they have become a part of the very thought and language of these and many other English poets. And finally, mythology is a rich treasure-house of interesting tales and stories. Because they appeal to young and old, because they are good and beautiful, these stories are in themselves worth our interest and study. Many of the most interesting of these stories are told in various places in these volumes. (*See* articles on chief personages figuring in Greek, Roman, and Norse mythology; *also* Fairies; Folk-lore.)

NAGOYA (*nä'gō-yä*), JAPAN. Nagoya is the fifth of the important cities of Japan. It is situated 30 miles from its port on the Grand Trunk Railroad, 235 miles from the capital, Tokyo, and about 94 miles from Kioto. Nagoya is famous for its potteries, and a dozen miles distant is Seto, where the first glazed pottery was made in Japan after its secret had been learned in China in 1229, by Kato Shirozaemon. For several centuries Seto maintained its supremacy in the pottery industry, and during the 19th century in the manufacture of porcelain. This industry is now, however, located chiefly at Nagoya, where there are also cotton mills and kindred industries, like that of dyed silk and cotton fabrics. Nagoya is also the home of the exquisite enamels of Japan and it was in Nagoya that the first "Cloisonné" ware was made. The most interesting building is the castle of Nagoya's feudal rulers, the Owari, now an art museum. Nagoya is a distinctly modern industrial city with a population of about 430,000.

NAILS. Did you ever see a nail-making machine at work? At one end soft steel wire is reeled into it at a tremendous rate, at the other end it pours out a stream of bright nails—a thousand a minute—with a roar like a machine gun or a steam riveter in action. Powerful nippers cut the wire into the required length, pliers fashion the point, and the head is formed by a hammer which strikes a terrific blow on the other end—and the whole nail is finished in a fraction of a second.

What a difference from nail-making in Colonial days, when every nail was laboriously hammered out by hand on an anvil! Many of the country folk of New England had small forges in their chimney corners, and there, on winter days and in the long evenings, when little other work could be done, quantities of nails were made, even by the older children. The nails were forged from "nail-rods" heated on the small hearth, and hammered and cut into the proper length. The heads were formed by

MAKING NAILS—A THOUSAND A MINUTE



This group of pictures shows you how wires are made into nails. After entering the machine and passing through the straightening rolls, the wire is caught by the grip die, which puts on the studs. Then the cutter closes upon the wire and cuts the point, while the heading hammer comes up against the lower end and flattens out the head. As soon as made, the nails are knocked off from the parent wire by the "nail shover," and fall into a basket at the rate of one thousand a minute!

dropping the spike into a hole in a piece of steel just deep enough to leave a small portion projecting to be hammered flat. No wonder nails were scarce and expensive in those hand-manufacturing days!

But now all we have to do is to insert the end of our coil of wire into the machine, turn on the power, and from time to time place a new keg to catch the nails as they stream out at the rate of from 100 to 1,000 a minute, depending on the size. Without this wonderful machine it would be impossible to furnish the nails needed in modern buildings. In the United States so many wire nails (to say nothing of other kinds) are used that if all those made in a year were cast into a single nail, that gigantic nail would be higher than the Eiffel tower.

The first man to invent a nail-making machine was Ezekiel Reed, a Massachusetts man who took out a patent in 1786. His machine in an improved form is still used for making cut nails. Strips of metal the thickness of the nail are fed into the machine, and a "slicer" cuts them into square-sided nail lengths, which are firmly clutched at the neck until the upper end is hammered into a head. These cut nails taper, but are not pointed.

About a century after the invention of this machine, the wire nail came into general use, almost driving out the cut nail, although the latter holds better and is more durable. About 13 times as many wire nails are now produced as cut nails. Common screws for cabinet and carpenter work—which are really only a form of nail—are made by automatic machines much like those that make nails.

Nails for shoeing horses are still for the most part hand-forged from fine grades of wrought iron. They must be tough and of the same composition throughout, so they will not break off in the horse's hoof.

Wire and cut nails are made of various metals—iron, brass, copper, zinc, etc.—and in a great variety of form, according to the purpose for which they are intended; as, for example, shingle nails, finishing nails, barbed box nails, flooring nails, boat nails, trunk nails, and picture nails. They are usually sold by weight, the price increasing as the nails grow smaller, and are distinguished in size as *twopenny* (1 inch), *threepenny* (1¼ inches), *fourpenny* (1½ inches), and so on up to the *60-penny*. Nails less than an inch long are called tacks and brads; those larger than the 60-penny size are called spikes. New England is the center of the nail industry, and Taunton, Mass., is the world's tack-making center.

Names, Personal. "Who Won the War? The Smiths!" This curious newspaper headline, which appeared not long after the close of the World War, was a humorous way of introducing the fact that there were 54,180 men by the name of Smith in the American Expeditionary Forces. The Johnsons, however, were not far behind, as the army lists showed 41,580 by that name. There were 29,960 Browns, 28,140 by the name of Williams, 25,720 of the Jones family, and 25,620 Millers.

Why should there be so many persons who bear these names? Let us find out by going far back into the history of names—one of the most fascinating and romantic of studies, because every name has a meaning and a story of its own, if only we search carefully enough.

In very early times, each person had only one name—his "given" name—which he might receive at the time of birth or later. Thus we are told in the Bible that when Hannah bore a son in answer to her prayer she named him Samuel, meaning "God hath heard." So Isaac meant "laughter"; Isaiah, "salvation of Jehovah"; Solomon, "prince of peace." In savage society names were frequently changed, just as nicknames arise with us. Thus an Indian brave who was called at birth "Morning Cloud" might in later life be known as "Deer Slayer," in commemoration of some exploit.

Where men lived in small tribal groups, this single name was enough. But in larger communities there would be many by the same name, and so it became customary to add some qualification—perhaps the name of the father—as a distinction. Thus you could distinguish between two men of the same name by calling one Demosthenes "the son of Clinias," and the other Demosthenes "the son of Socrates." With the Romans this practice developed into the use of genuine "family names," which descended to all members of the same house, in addition to the "personal name" borne by the individual.

Origin of English Family Names

Family names did not arise as a usual thing until after the time of the Conquest (1066), and so genealogies which purport to trace descent back of this date are nearly all frauds. There were so many Johns and Samuels and Williams with nothing to distinguish between them that it became convenient to refer to a man as John the *smith*, John the *miller*, or John the *carpenter*, and so presently these designations became fixed as surnames or family names. The names Taylor, Wright, Turner, Clark (clerk), Cook, Carter, and Gardiner are a few of the many derived in this way from occupations. The reason there are so many Smiths today is that in medieval times the name was applied to all workers in or *smiters* of metal—blacksmiths, who worked in iron, whitesmiths, who worked in tin, locksmiths, etc.

Another common way of forming surnames was from the Christian name of the father. Such names are called *patronymics*, meaning "father-names." Johnson is simply "John's son," and Jones and Jennings are modified forms of the same surname. Williams, Williamson, and Wilson all mean "the son of William."

The name Brown was first given to a man as a nickname because of his complexion, or possibly because of the color of his dress. In like manner the names Long, Short, White, Little, Longfellow, and Cruikshank were derived from personal characteristics. Other names were derived from the place

where a man lived or from which he had come, as Hill, Cliff, Field, Whitfield, Dale, Ford, Lake, Wood, Atwood, Wells, Moore, as well as Scott, English, Ireland, Irish, France, French.

Animals have given us many of our surnames, partly because of the ancient custom of using signs instead of numbers to distinguish shops and inns. Thus a man might become known as Lyon (lion) either because of his courage or because the sign hanging before his shop bore the figure of a lion. Other familiar examples are Bull, Hart, Lamb, Stagg, Peacock, Swann, Fox, and Badger.

Surnames Built from Bible Names

Biblical characters and saints have furnished many surnames. Adam has given the familiar names Adams, Adamson, Ade, Atkins, and Atkinson, all of which mean "the son of Adam." From Elijah come Ellis and Eliot; from Matthew, Matthews and Mayo; from Andrew, Andrews and Anderson. Names of saints are very common, such as Gregory, Martin, Lawrence, Nicholas, Vincent, and Austin (from Augustine). Mitchell is a derived form of Michael, one of the archangels. Phelps comes from Philip.

Some names have come from buildings, as Temple, Hall, House, and Church. From the seasons we get Winter, Summers, and Somers. From points of the compass come North, Southey, Eastman, West.

Thus we see that there was once a reason for every name, though some names are very ill suited to the descendants who bear them now, as the writer of the following verses points out:

Men once were surnamed from their shape or estate
(You all may from History worm it);
There was Lewis the Bulky, and Henry the Great,
John Lackland, and Peter Hermit.
But now, when the door-plates of Misters and Dames
Are read, each so constantly varies
From the owner's trade, figure, and calling, surnames
Seem given by the rule of contraries.

Miss *Joy*, wretched maid, when she chose Mr. *Love*,
Found nothing but sorrow await her;
She now holds in wedlock, as true as a dove,
That fondest of mates, Mr. *Hayter*.
Mr. *Oldcastle* dwells in a modern-built hut,
Miss *Sage* is of madcaps the archest;
Of all the queer bachelors Cupid e'er cut,
Old Mr. *Younghusband's* the starchest.

Mr. *Child*, in a passion, knocked down Mr. *Rock*,
Mr. *Stone* like an aspen-leaf shivers;
Miss *Poole* used to dance, but she stands like a stock
Ever since she became Mrs. *Rivers;*
Mr. *Swift* hobbles onward, no mortal knows how,
He moves as though cords had entwin'd him;
Mr. *Metcalfe* ran off, upon meeting a cow,
With pale Mr. *Turnbull* behind him.

The Macs, the O's, the Aps, and the Fitzes

In most foreign languages surnames are formed in much the same ways as in English. Corresponding to the English suffix *-son*, we find the Scotch prefix *Mac*, the Irish *O'*, the Norman-French *Fitz*, and the Welsh *Ap*, which give us the names Macdonald, O'Brien, Fitzherbert, and Bowen (originally Ap-Owen). The Russian suffix *-ovitch* likewise means "son," hence the Russian name Ivanovitch, son of Ivan, or John, corresponds to the English Johnson. The Swedish *-son* and the Danish and Norwegian *-sen* are seen in a very large percentage of Scandinavian names. It is only within the last century that the practice has died out in the Scandinavian countries of giving the son a surname formed from his father's Christian name. Thus for example, in former times, if Hans Petersen had a son he would name him Ole Hansen, while the latter's son would be Jan Olesen.

One of the most interesting groups of names is that which includes Jewish names of German origin. Until the beginning of the 19th century Jews for the most part adhered to the ancient custom of using only a given name. When laws were passed in Austria, Prussia, and Bavaria to compel all Jewish families to adopt fixed surnames, some chose personal names such as Jacobs, Levy, Moses; others formed place-names, as Speyer (spires), Hamburg, Frankfurter. The famous Rothschild family got its name from the red shield over Nathan Rothschild's shop in Frankfurt. Many took highly colored and poetical names such as Rosenberg (rose-mountain), Gluckstein (luck stone), Rubenstein (ruby), Goldenkranz (golden wreath). Animal names were also favorites, as Adler (eagle), Hirsch (hart), Lowe (lion), Fuchs (fox), and Wolf.

NANKING, CHINA. By its name, which means "southern capital," Nanking reminds us that it was once the proud capital of the Celestial Empire during the reign of the first two emperors of the Ming dynasty in the 14th century. When the third Ming ruler left the city for Peking (which means "northern capital"), the importance and population of Nanking began to decline. But because of its strategic setting amid sheltering hills on the Yangtse River, 130 miles from its mouth, Nanking has often since been the coveted object of internal struggles. It has never recovered from the ruin caused by the Tai-ping rebellion (1850–64), and a large part of the area within its walls is still unoccupied. In the revolution of 1912 the republicans captured it and made it the capital of their provisional government.

Reminders of Nanking's past glories are everywhere. Outside the great walls stand the tombs of the Mings, guarded by rows of colossal figures carved in stone. In the center of the city is the huge Drum Tower where emperors are said to have stood beating upon drums to encourage their soldiers when rebels attempted to storm the walls. Besides these revered antiquities the citizens of Nanking take pride in the city's clean well-paved streets, a rarity in Chinese cities, their modern arsenal, and their university.

The yellow cotton cloth called "nankeen" takes its name from this city, where it was originally manufactured. Today Nanking is one of the most important cities of China in the weaving of silk. It is also famous for its paper, ink, and artificial flowers. Population, about 400,000.

NANTES (*nänt*), **FRANCE.** In its long and varied history, dating back to the Celtic Nannetes who ruled here before the coming of the Romans, the most memorable event associated with Nantes was the issuance here of the famous Edict of France, by which Henry IV in 1598 granted toleration and civil

rights to the Huguenots or French Protestants (*see* Henry, Kings of France). Today its position on the estuary of the Loire River, about 50 miles from the sea, and its chain of connecting canals make it one of the seven chief seaports of France. Sugar, tobacco, sardines, and preserved foods, with iron works and ship-building, are the principal industries. Nantes contains a number of historic public buildings, among them an unfinished cathedral of great beauty. Historically, it is one of the chief cities of Brittany, that land of picturesque people and customs. During the World War of 1914–18 several American hospitals were located here. Population, about 170,000.

Naples, Italy. To catch the spirit of Naples the visitor must see it first as he sails between the islands of Ischia and Capri, and enters the celebrated Bay of Naples, some 22 miles wide. There at the bay's northern apex lies the largest, noisiest, most picturesque, and most fascinating of Italy's historic cities. As the ship plows forward, through the bluest of waters under the bluest of skies, the sloping city appears, flanked seven miles to the east by the ominous bulk of Mount Vesuvius, and on the west by the graceful heights of Posilipo. In the background an amphitheater of volcanic hills curls around the city, which has been called the most beautifully situated in all Europe. To the lovely island of Capri go 30,000 tourists every year, to enjoy the balmy air and the picturesque scenery and to view the ruins of the palaces in which the profligate emperor Tiberius spent the last seven years of his life.

From a crest north of the city, where stands the massive bulk of St. Elmo Castle, built in the 16th century and now used as a prison, a spiny ridge runs down to the sea, splitting the city in two. This ridge ends in a rocky islet, on which stands the Castello dell' Ovo—so called because it is egg-shaped—built in the 12th century.

In the older and larger part of the city, to the east of this ridge, the spires of scores of ancient churches rise, intermingled with large public buildings, and here and there a factory chimney. In this quarter the poorer people live, and here centers the industrial and political life of the city. On the western side of the ridge are the new fashionable dwellings of the rich, built on terraced hills and commanding sweeping views of the bay, with the twin mountains of famous Capri in the far distance.

How Naples Suffered from Growing too Fast

Naples is said to be the most densely populated European city. During the last century its population increased at a rate far more rapid than did its dwelling places, and for many decades the poorer people were crowded together so thickly that disease, crime, and vice flourished hopelessly in filthy tenements. In 1884 a fierce epidemic of cholera broke out which carried away thousands of victims. Shortly afterward the center of the old district was literally torn out by the roots. Modern buildings and broad streets were built, an excellent water supply was piped in, and conditions improved at once. Even today the thriving business carried on by its factories, and the immense exports and imports which pass through its magnificent harbor, continue to draw people to Naples. Dwellings are crowding out the beautiful gardens and groves, while the expansion on the outskirts bids fair soon to connect the pretty chain of small suburbs on the shores of the bay into one huge city.

Naples is a center for the manufacture of silks, cottons, and woolens, glass, coral, tortoise shell, and other art objects, kid gloves, tobacco, olive oil, soaps, perfumes, chemicals, and macaroni. Machinery, guns, and other objects of steel and iron are growing in importance; and wine is an important export. But a carefree spirit seems to mark the city's industrial life. The workers from the factories, the peddlers pushing their carts in the markets with shrill cries, the mule drivers from the surrounding country bringing in their produce, the fishermen from the nearby villages—all mingle together in the streets in a gay and noisy throng, shouting, waving arms, singing and laughing—all this presents a scene not matched anywhere in the world.

A Population of Art Lovers

The instinctive love of beauty which is characteristic of the Neapolitans is reflected not only in their picturesque costumes, but in their appreciation for serious art. Naples is filled with museums, theaters, and opera houses, among which is San Carlo, one of the largest opera houses in Europe, where many of the best singers in the world may be heard.

Many remains of classical days add to the city's historical interest. The cathedral, one of the principal edifices, dates back to 1272, and stands on the spot where were formerly two temples dedicated to Neptune and Apollo. Naples was one of the earliest centers of learning in Europe. Its university was founded in 1224, while that of its neighbor Salerno, 25 miles to the southeast, dates back to 1150—the oldest in Europe. The National Museum of Naples is one of the most important in the world. In it are housed objects dug up at Pompeii and Herculaneum and unequaled Greek and Roman relics, as well as collections belonging to the Italian crown, the Farnese group of paintings and sculpture, and 600,000 books, pamphlets, and manuscripts containing many rare historical writings. A big Marine Aquarium contains the largest collection of living sea animals in the world and its laboratories attract zoölogists from all parts of the globe.

Naples was an old Greek settlement (called *Neapolis*, "the New City"), founded about 450 B.C., when southern Italy and Sicily were styled *Magna Graecia* ("Greater Greece"). The Romans conquered it in 326 B.C., but the Greek language and customs survived down into the days of the Roman Empire. It suffered in the 6th century when the generals of the eastern Emperor Justinian wrested it from the East-Gothic conquerors of Italy. The Normans con-

quered it about 1130, and it became the capital of the "Kingdom of the Two Sicilies," which these mighty descendants of the Northmen set up in southern Italy. It flourished greatly under the enlightened Frederick II, of the Hohenstaufen house, whose mother was the last of the Norman line. He it was who founded its university, and in this court, where mingled Greek, Saracen, Teutonic, and classical elements, the first stirrings of the Renaissance were manifest. With the pope's aid the descendants of Frederick II were finally overthrown and Charles of Anjou was seated on the throne (1266).

For centuries this territory was then the scene of violent intrigue and war. From 1266 until 1494 it was fought over by Angevin and Aragon princes; then the kings of France and Spain alternately took possession, until the latter gained the ascendency in 1504, ruling the Two Sicilies until 1713. After the War of the Spanish Succession (1701–13) the Two Sicilies passed to the Austrian Hapsburgs, who surrendered it to a branch of the French house of Bourbon in 1743. While Napoleon Bonaparte was making Europe over, his brother Joseph sat for a time on the throne, and then Joachim Murat, Napoleon's brother-in-law. After Napoleon's fall Naples returned to the Bourbon government until it was liberated by Garibaldi and became a part of United Italy in 1861 (*see* Garibaldi; Italy).

Naples was long the home of an infamous secret organization known as the *Camorra*, which plied its trade of robbery, blackmail, and assassination for more than a century. At times the Camorra was so powerful that it was in full control of the city government; but in 1912, after a famous trial, 30 of its leaders were condemned to long prison terms and its strength was greatly lessened. Population of the city, about 700,000 (approximately 100,000 more than the city of Rome).

The CORSICAN *Who* CONQUERED *Half of Europe*

NAPOLEON (*nȧ-pō'lā-ôn*) I, EMPEROR OF THE FRENCH (1769–1821). Not a drop of French blood flowed through the veins of Napoleon Bonaparte, who for 16 years was the absolute master of France. He was barely a Frenchman by birth, for the island of Corsica, in which was located his native town of Ajaccio, was handed over to France by Genoa in 1768, only a year before Napoleon was born.

Napoleone Buonaparte—such was the Italian name under which he was christened—was a typical Corsican, "moody and exacting but withal keen, brave, and constant." For years his most intense emotion was hatred of France, which he regarded as an oppressor of his native land. He carried this feeling with him to the government military school at Brienne, in northeastern France, to which he was admitted at the age of nine. His five years spent at Brienne were not happy ones and he frequently engaged in fights with the French lads who thought him a gloomy sullen lad. He spent his leisure in dreaming of the time when he should free Corsica. At the age of 16 he began his service in the French army as second-lieutenant of artillery. But his proud nature, his poverty, and his foreign birth and accent still cut him off from his fellows.

The stirring events of the French Revolution, which broke out in 1789, aroused little interest in him. His thoughts were all on Corsica, and he absented himself from the army for long periods to engage in plots at home. His schemes were not successful, however, and it was with difficulty that he escaped to France, an outcast from his native shores. His love for Corsica was thenceforth dead; it meant no more to him than did Malta or Corfu. There came a time when he declared, "Among all the insults hurled against me, that of 'Corsican' is the most mortifying." He gave his name its French form, and his marriage in 1796 to Josephine Beauharnais, the widow of a Frenchman, was another step away from his Corsican nationality.

THE STRANGE BOY IN THE MILITARY SCHOOL

"The mighty tread of the Emperor's footsteps on the Continent soon drowned the echoes of the cannon of Trafalgar," wrote the French historian, Thiers, speaking of this moody and solitary boy who is here pacing the grounds of the military school at Brienne, to the amusement of his fellow students. At that time the great Napoleon was only a friendless alien who spoke French with an Italian accent, while his fellow students were sons of the aristocracy of France. Their taunts made his life miserable, and he grew to a morose and pessimistic young manhood.

Now that his boyhood ambition was gone, what was to take its place? Perhaps, for a time, nothing. In 1793, at Toulon, he first gave evidence of his energy and genius in directing the artillery in the siege of that rebellious French city. This fixed the attention of the leaders of the government upon him. "If you are ungrateful towards him," wrote his commanding officer, "this man will contrive his own advancement." But for a time fate was against him. Robespierre and the Jacobins, with whom he had established friendly relations, fell from power; and in 1795 Napoleon was back in Paris, deprived of his command, without money or friends and suspected because of his Jacobin connections.

That year was the last year of misfortune for a time. In October, with what Carlyle called a "whiff of grape-shot," he defended the Convention (the legislative body) against a radical Parisian mob. Everybody was amazed at his energetic arrangements, his clear and prompt orders. Amazement gave way to admiration, then admiration to confidence, and finally confidence to enthusiasm.

Marvelous Campaign in Italy

The Directory, which now sought to bring order into the Revolution, rewarded the young man with the pale face and unkempt hair by making him commander of the French Army of Italy, operating against the Austrians and their allies. This appointment formed the opening of a military career which, in extent and grandeur, hardly finds a parallel in history except that of Alexander the Great. Of all Bonaparte's campaigns none is more interesting, perhaps, than this first one in Italy, in 1796–97. Even older and more experienced generals serving under him yielded to his indomitable will, his flashing eye, and his brilliant plans. His men were thrilled by the burning words of his first proclamation: "Soldiers, you are ill-fed and almost naked. The government owes you much, but can do nothing for you. Your patience and courage do you honor, but procure you neither glory nor profit. I am about to lead you into the most fertile plains of the world. There you will find great cities and rich provinces. There you will win honor, glory, and riches. Soldiers of the Army of Italy, will you lack courage?"

The campaign showed General Bonaparte's great military genius, and stirred to life again great ambition. His quick mind seized every geographical detail which might help or hinder his operations. He was prompt to guess the plans of his enemies, whom he bewildered by his rapid movements. His favorite device was to cut the enemy's army in two, and then throw his whole force against one of the enemy fragments before they had a chance to re-unite. By this

THE MARRIAGE OF NAPOLEON AND MARIE LOUISE

We are here witnessing the magnificent wedding of the great French Emperor to Marie Louise of Austria. Although the marriage was originally contracted for political reasons, following the Emperor's divorce of Josephine, Napoleon was desperately in love with this daughter of the Hapsburgs. Their only son was called Napoleon II and formally crowned king of Rome, but this was only an empty title after Napoleon was overthrown. After his first overthrow, Marie refused to join him in Elba and during the desperate Hundred Days expressed no interest in him. Nevertheless, Napoleon both excused and forgave her desertion.

method in 1796 he defeated the Sardinian troops five times in eleven days, threatened their capital (Turin), and forced their king to make peace.

Then Bonaparte turned eastward against the Austrians. His bravery was shown when in the face of a withering fire he forced his way across the bridge at Lodi—an exploit that won from his troops the affectionate name of the "Little Corporal." He then besieged a part of the Austrian forces in Mantua. Four times the Austrians sent armies across the Alps to relieve that fortress, but each time Bonaparte defeated them, and finally the fortress fell in February 1797. He then carried the war into Austria itself, and had advanced to within 80 miles of Vienna when the enemy offered to make peace. According to Bonaparte's proclamation, he had been victorious in 14 pitched battles and 70 combats. His army had conquered rich lands which fed and paid the army during the campaign, and sent millions of francs to relieve the financial distress of the home government. By the treaty of Campo Formio, which Bonaparte negotiated with Austria, France was given Belgium (the Austrian Netherlands), and accepted the Rhine as the eastern frontier of the republic and the Cisalpine Republic which he had erected in northern Italy. In return he gave to Austria most of the territories of the old Venetian Republic, which Bonaparte had high-handedly destroyed. All this he had done with an army of only about 50,000 men.

When the conqueror of Italy returned to Paris he was given a triumphal reception such as had been given to no other general of the Revolution. Thirst for political power had now replaced his youthful ambition for Corsica. "Do you suppose," he is reported to have said, "that I have gained my victories in Italy in order to advance the lawyers of the Directory?" But the "pear was not yet ripe for picking," he felt, and so, because he was afraid that the people might tire of him if they saw him too much, he meditated an invasion of England. He finally persuaded the willing Directory to send him to Egypt. There on the banks of the Nile he expected to imitate the exploits of Alexander the Great, and at the same time to strike a blow at France's most powerful enemy, England, by opening a route to India. But here he was doomed to disappointment. The Battle of the Pyramids, fought near Cairo (July 1798), put Egypt at his mercy; but his fleet was destroyed by the British in the Battle of the Nile at Aboukir Bay (*see* Nelson, Horatio), and he was cut off from reinforcements. At Acre, in Syria, British troops fighting alongside those of Turkey defeated Bonaparte's plans and threw him back on Egypt. At last disquieting news from France led Bonaparte to slip away from his army in Egypt and return secretly to France.

There he found the Directory discredited because of its disastrous wars in his absence. Bonaparte joined accordingly in a plot which in November 1799

overthrew the Directory and set up in its place a government called the Consulate, with Bonaparte as the first of the three consuls. Three years later he became First Consul for life with the right of appointing his successor. Thenceforth he styles himself "Napoleon I" instead of "General Bonaparte."

The pear was now ripe and had been picked. Napoleon had grasped political power and become master of France. His old ambition was realized, but already new ones were forming. He had failed to build up a great eastern empire like that of Alexander the Great. He now aspired to restore the western one of Charlemagne.

By the hard-fought battle of Marengo (1800) he defeated the Austrians. The German states and even England, worn out by war, were ready to give up the struggle, and by the treaty of Amiens, in 1802, France was at peace with the whole world for the first time since 1792. But even in peace the First Consul continued to carry out his ambitious plans. In the 14 months before the conflict began anew, he became president of the Italian Republic, intervened in Switzerland, annexed Piedmont, Parma, and the island of Elba to France, planned the partition of Turkey, and the foundation of a colonial empire which should include America, Egypt, India, and Australia.

Do you wonder that Great Britain felt compelled to renew the conflict and worked hard to build up the Third Coalition (composed of Great Britain, Russia, Austria, and Sweden) against this arch-disturber of the peace? But still Victory smiled on Napoleon. By his complete defeat of the Austrians and Russians at Austerlitz (Dec. 2, 1805), by his crushing blow to the Prussians at Jena (Oct. 14, 1806), and by the battle of Friedland against the Russians (June 14, 1807)—"the worthy sister of Marengo, Austerlitz, and Jena"—Napoleon brought most of Europe to his feet.

Only one obstacle apparently barred his way to the complete mastery of western Europe; that was Great Britain. In 1805 he had planned to invade that island and reduce it to submission. But the favorable moment never came and after England's navy under Nelson had destroyed the French fleet in the battle of Trafalgar (October 1805), Napoleon had no chance to conquer that enemy in battle, and his economic blockade of Britain proved equally futile.

Napoleon's fame rests not only on his military genius but also on his work as a statesman. He was obliged to make treaties, to reorganize the lands he had conquered, and to govern France. He had an inexhaustible appetite for work and an extraordinary capacity for it. He mastered the details of business with almost superhuman energy and intelligence. A sound currency was established in France, the Bank of France created, roads and canals improved, agriculture and industry fostered. The machinery for local government was simplified and strengthened by a system of departmental *prefects* and *subprefects*, appointed by his government at Paris. The Catholic church, which had been suppressed in the course of the Revolution, was reëstablished by an agreement with the pope, known as the Concordat of 1801. Military ambitions were stimulated by the formation of the Legion of Honor, to be composed of soldiers and civilians who had greatly served the state. Most important of all, the old confused system of law was swept away, and Napoleon, with the aid of a committee of learned jurists, constructed a system of rational law—the Code Napoleon—to take its

THE RETREAT FROM MOSCOW

Four hundred thousand men marched into Russia, and a few months later back came the little handful of survivors—fewer than 20,000—in rags and starving. The way was strewn with the dead and dying, and as the Emperor rode past, many of the suffering soldiers who had fallen by the roadside called down curses on his head.

"WHERE IS THE MAN WHO WOULD SHOOT HIS EMPEROR?"

This picture shows one of the most remarkable incidents in the career of Napoleon. It happened after he had escaped from Elba with a handful of soldiers and set out for Paris. As he approached the city of Grenoble, a general of the royal forces in command of 6,000 men was sent out to take him prisoner. On meeting them Napoleon dismounted and advanced alone. The order to "Fire" had already been given. But Napoleon, baring his breast, said: "Where is the man who would shoot his emperor?" At his words the soldiers who had been sent to stop him threw down their guns and hailed him as their leader.

place. "My true glory," said he after his downfall, "is not that I have gained 40 battles. Waterloo will efface the memory of these victories. But that which nothing can efface, which will live forever, is my civil code."

Step by step, too, Napoleon was building up his own position. In 1804 he secured a popular vote sanctioning a change from the consulate to an empire, with the title "Emperor of the French" and the right to hand down the throne to his descendants. In order to obtain a son to succeed him and also to ally himself with one of the old royal families of Europe, he divorced Josephine in 1809 and married Marie Louise, the 18-year-old daughter of the Austrian emperor. He set himself, also, to the work of reorganizing Europe. The Cisalpine Republic was now changed to a monarchy and he himself was crowned king of Italy with the famous "iron crown" of Lombardy. "Roll up that map of Europe; there will be no need for it for ten years to come," the English minister Pitt had said after the battle of Austerlitz. For almost that period Napoleon changed the map at his will. His stepson Eugene was made viceroy of Italy. Napoleon's brother Louis became king of Holland; and Joseph, king first of Naples and then of Spain—General Murat, who had married Napoleon's sister, succeeding to the vacant Neapolitan throne. His dependents the dukes of Bavaria and Württemberg were given the rank of kings. The shadowy Holy Roman Empire was dissolved, in 1806, and many of the petty German states were given to their more powerful neighbors, until the number of German states were reduced from some hundreds to about 50. This was the first step in the consolidation of Germany. At the height of his power the French Empire included France to the Rhine, Belgium and Holland, parts of Italy, and Croatia and Dalmatia. Spain, the rest of Italy, the Grand Duchy of Warsaw, and the confederation of the Rhine were dependent on Napoleon, and Denmark and Norway, Prussia, and the Austrian Empire were allied with him. Only Great Britain, Russia, Sweden, and Turkey remained independent of him.

Napoleon freely used the schools to maintain his power. The political creed for the rising generation was set forth in a catechism to be taught in the schools in these terms: "We owe to our Emperor, Napoleon I, love, respect, obedience, fidelity, military service, and the tribute ordained for the defense of the empire and of his throne." In reply to the question as to what was to be thought of those who were unfaithful in their duties toward the emperor, the

catechism replied: "According to St. Paul they sin against the ordinance of God, and are guilty of everlasting damnation."

The high point in Napoleon's career was reached in the years which followed the peace of Tilsit (1807). There, on board a raft in the Niemen River, the Czar Alexander of Russia not only made peace but was won over to Napoleon's plans. Napoleon and Alexander were to divide Europe between them. In return Alexander was to aid Napoleon in his "Continental system." The object of this was to close Europe to England's commerce and thereby force that "nation of shopkeepers," as he contemptuously called it, to sue for peace. At one time or another every state of continental Europe, except Turkey and Portugal, was forced into this commercial system. But all objected to it, because they needed goods from England; and so all found methods of evading the conqueror's decree until they could throw off his yoke.

THE FALLEN EMPEROR ON HIS "ROCK"

The man who had been master of Europe, who had made and unmade kings and emperors, spent his last days on a lonely island—St. Helena, 700 miles from the nearest land. Once the overlord of an entire continent, he came to be a prisoner who could not even call his own the barren bit of land to which he was exiled. "My rock!" he used to say with grim humor, in speaking of the island, yet he could not even take a walk without a British soldier at his heels.

Napoleon had also aroused another great force, which was to bring about his downfall—the spirit of nationalism. In Spain the patriotic fire against French conquest first blazed forth in 1808. The British sent troops to help in this "Peninsular War" (1808–14), and little by little the French were pushed back beyond the Pyrenees.

The day of downfall was approaching. Austria plucked up courage to renew the struggle, but was crushed by the bloody battle of Wagram (July 1809). Then Napoleon struck back of her at Russia, for deserting his Continental system. With an army of nearly half a million men, drawn from "twenty nations," he plunged into that country. On and on he went into the heart of the country, until he finally reached Moscow. Suddenly the day after his arrival (Sept. 14, 1812) flames burst forth, probably set by the Russians, and nine-tenths of the city was reduced to ashes. It was impossible to winter in the ruined city, and on October 19 Napoleon began his retreat across snow-covered plains. This retreat from Moscow, celebrated in art and story, became one of the tragedies of history. Of the mighty force of 400,000 that had set out in June, less than 20,000 ragged, freezing, and starving men staggered across the Russian frontier in December.

Napoleon's great career of conquest was over. The flames of national patriotism burst forth in an uprising of Europe. Austria, Russia, and Prussia all joined with Great Britain in the War of Liberation. With renewed effort Napoleon raised new armies and won a few unimportant victories; but in the three-days' battle of Leipzig—called the Battle of the Nations—(October 1813) the French were outnumbered, outgeneraled, and outfought. Slowly but surely the allies then closed in upon Paris — Russians, Prussians, and Austrians from the east and north, and the British and Spaniards from across the Pyrenees. On the last day of March 1814, they entered the French capital. Napoleon's generals refused to continue the hopeless struggle, and he was forced to abdicate (April 11, 1814). He was allowed to retain the title of Emperor, together with the little island of Elba (between the west coast of Italy and Corsica), and was promised an annual payment of 2,000,000 francs. In the person of Louis XVIII the Bourbons returned to power.

But to remain quietly so near France without trying to regain his lost power was an impossibility for Napoleon. In March 1815, he slipped quietly away from Elba and landed in France. As by magic an army rallied to his support, and for a brief "Hundred Days" he enjoyed a return of his ancient glory. But the allies again united their forces against him and on the field of Waterloo he was decisively and finally defeated (*see* Waterloo, Battle of).

To avoid falling into the hands of Blücher, who had sworn to shoot him as an outlaw, Napoleon sought refuge on board a British man-of-war and surrendered. He was now sent to the lonely British isle of St. Helena, in the South Atlantic, 1,200 miles west of Africa. His wife Marie Louise deserted him and his only son was reared in Austria and died as the Duke of Reichstadt in 1832. At St. Helena Napoleon fretted out the remainder of his life, until his death from cancer in 1821, in quarrels with his guards.

Napoleon III, Emperor of the French (1808–1873). Royal birth, a princely heritage, an imperial name, a cardinal to christen him, an emperor and empress to stand his sponsors, early exile, persecution, youthful wanderings in search of a home, reckless invasions, miraculous escapes, imprisonments, and flights in disguises—these were the circumstances in the life of Louis Napoleon which eventually led him to the throne of France as Napoleon III.

His first period of youthful magnificence made little impression on the boy, for he was only two years old when his father, Louis Bonaparte, stepped down from the throne of Holland. When he was seven his uncle Napoleon I fell from his proud position and was exiled to the lonely island of St. Helena. Then began a long period of wandering in search of a home, Switzerland, Germany, England, and America all sheltering him for a time.

But wherever he was and whatever he did, he was always planning for the restoration to rule of the Bonaparte family in France. This was especially true after 1832, when the son of Napoleon I—the Duke of Reichstadt—died. This left Louis Napoleon as the next heir of the great conqueror.

So firm was his faith in his "star of destiny" that he twice made adventurous attempts to seize power in France, but these only brought ridicule upon himself. His opportunity came in 1848, when a revolution drove Louis Philippe from the throne and a French republic was established. Among the names of the candidates for the presidency of the new republic only one was known to the peasants—that of Louis Napoleon. They remembered only the glories of the rule of the first Napoleon, and forgot his costly wars and his despotism; so by an enormous majority they elected his nephew president.

Louis soon began to follow in the footsteps of his illustrious predecessor. In 1851 he overthrew the old constitution and made a new one giving him unlimited power for ten years. A year later he assumed the title of "Napoleon III, Emperor of the French," the son of Napoleon I being counted as Napoleon II. All of these changes were submitted to the people for their approval in plebiscites, but the elections were carefully controlled so that the people would vote as Napoleon wished. Neither Napoleon I nor any Bourbon king could have been more absolute than was Napoleon III during the first eight years of the empire (1852–60). He muzzled the legislative body, he shackled the press, and he controlled the elections. But the people were ready to give up their liberty in return for the prosperity they enjoyed. Napoleon organized banks, built railroads, constructed canals, established hospitals, and gave the laboring men the right to strike. With England, Turkey, and Piedmont as allies, he also won a place among the nations by engaging in a successful war in the Crimea against Russia, in 1854–56 (*see* Crimea).

"The Empire is peace," Napoleon had once declared, and if he had followed this policy all might have gone well with him. But he longed to win military glory as Napoleon I had done, though he himself had no military training. The Franco-Austrian War in Italy in 1859 made for him many enemies (*see* Cavour, Count). His unsuccessful attempt to establish Emperor Maximilian in Mexico still further discredited him (*see* Mexico). In fact his whole foreign policy in the latter days of his empire was a failure.

In an effort to reduce the growing opposition to his rule he began granting political reforms. The period 1860–70 was thus one of new liberalism in the empire. The powers of the legislature were restored, and ministers responsible to it were appointed. Freedom of the press was granted. But his popularity was too far undermined for these concessions to save him. When France was crushingly defeated in the Franco-Prussian War, in 1870–71, the whole structure of the Second Empire toppled to the ground.

Napoleon himself was taken prisoner of war when the French army surrendered to the Germans at Sedan, on September 2. "Down with the Empire! Long live the Republic!" shouted the people in Paris, and on September 4 the Third Republic was born. The Empress Eugenie, his beautiful Spanish wife who had wielded a harmful influence on his reign, fled to England, and there Napoleon III joined her after his release at the close of the war.

So began his second exile, which lasted until his death, three years later. He so lacked the genius of Napoleon I that Victor Hugo called him "Napoleon the Little." His name was his principal asset, and with his overthrow the Bonapartist cause was effectually destroyed. The Empress Eugenie, saddened by the death of their only son in a British war in South Africa, lived on in lonely widowhood until 1920.

Narcissus. One of the prettiest sights of the Alpine meadows in springtime are the wide fields of the white or yellow narcissus which there grows wild. The blossoms, drooping from the end of a tall slender stalk, have an exquisite grace, and a rather spiritual beauty. Their fragrance is overpowering and can often be noticed a mile away. The plant is a native of southern Europe, northern Africa, Persia, China, and Japan. It was beloved by the ancients and about it cluster many myths and legends. Greek myths tell of a beautiful youth, Narcissus, who, because he had spurned the love of Echo, was condemned by Aphrodite to lose his heart to his own image reflected in a clear pool. Fascinated, he gazed day and night at the beautiful apparition and became weaker and weaker from lack of food, until he pined away and died. The gods in compassion then changed him into this lovely flower that grows near quiet pools.

There are several species of the narcissus, including the daffodils and jonquils. The poet's narcissus (*Narcissus poeticus*) is celebrated in Greek and Roman verse. The trumpet narcissus (*Narcissus pseudonarcissus*) is the common English daffodil. *Narcissus polyanthus* is the parent of the cultivated varieties

which are grown so extensively by florists and treasured as garden flowers.

The paper white narcissus is so sturdy that it can be grown in winter in our living rooms. The bulbs should be set in a deep bowl, surrounded with stones to keep them in place, and kept well covered with water. They should be placed in a dark, cool place until the heavy mat of roots has formed and the leaves have started. They then want plenty of sunlight, but not too much heat, and if kept in a temperature of from 60 to 65 degrees will bloom delightfully.

NARCISSUS IN BLOOM

Imagine yourself in the Alps in spring and the meadows covered with flowers like these!

Narcissus tazetta is the scientific name of the ordinary paper white narcissus. Flowers white, 1 to 1½ inches across, growing in clusters of 4 to 13 at the top of a tall, round scape; perianth tube about 1 inch long, broadening into 6 segments; tiny corona, crinkled and scalloped at the throat of the tube; stamens 6 in number, 3 near the throat of the tube, 3 lower down; leaves very narrow, growing to a height of 1 to 2 feet from base; bulb about 2 inches across.

NASHVILLE, TENN. Besides being the capital of Tennessee and, next to Memphis, the largest city of the state, Nashville is one of the foremost educational centers of the South. Hence it is sometimes called "the Athens of the South." It is the home of no less than 80 schools and colleges, including Vanderbilt University; George Peabody College for Teachers; and Fisk University—an institution for the education of negroes which was sung into fame by the Fisk "jubilee singers."

The city is built upon a series of limestone hills, on both banks of the Cumberland River, which is navigable for large steamers most of the year. On the loftiest hill stands the capitol building, a fine example of Greek architecture, overlooking the city as does the Acropolis of Athens; and upon another elevated site is the house in which once lived President James K. Polk. The "Hermitage," the historic mansion of President Andrew Jackson, is a few miles east of Nashville. One of the several beautiful parks, which occupies the grounds of the Tennessee Centennial Exposition of 1897, contains a museum and art gallery.

Situated in the fertile green hills of central Tennessee, with good railway and steamboat transportation, and almost at the edge of an inexhaustible coal field, Nashville has become a great commercial and manufacturing city. It is one of the largest live stock and wheat grinding markets in the South, and one of the largest hardwood markets in the United States. It also has a good trade in cotton and tobacco. Population, about 120,000.

Nashville played an important part in the Civil War, as is witnessed by the National Cemetery, containing the bodies of nearly 17,000 soldiers. The battle of Nashville, fought on Dec. 15 and 16, 1864, ended the main campaign of the war in the west, for in it Gen. George H. Thomas, the Union commander, defeated Gen. John B. Hood so badly that the forces of the latter never again appeared in the field as an army. Ten miles south is the battlefield of Franklin, one of the bloodiest battles of the Civil War in proportion to the numbers engaged.

NASTURTIUM. Without the gay yellow, orange, or red blossoms of the nasturtium our summer gardens would be incomplete. The plant is a native of South America, and is said to have been introduced into England by way of Spain and France about 1596. It was valued especially because of its pungent and aromatic juices which were supposed to ward off the dread disease of scurvy, so common among sailors on long voyages. There are about 20 species of nasturtiums. The flowers and leaves are often used in salads and the green seed pods are sometimes pickled.

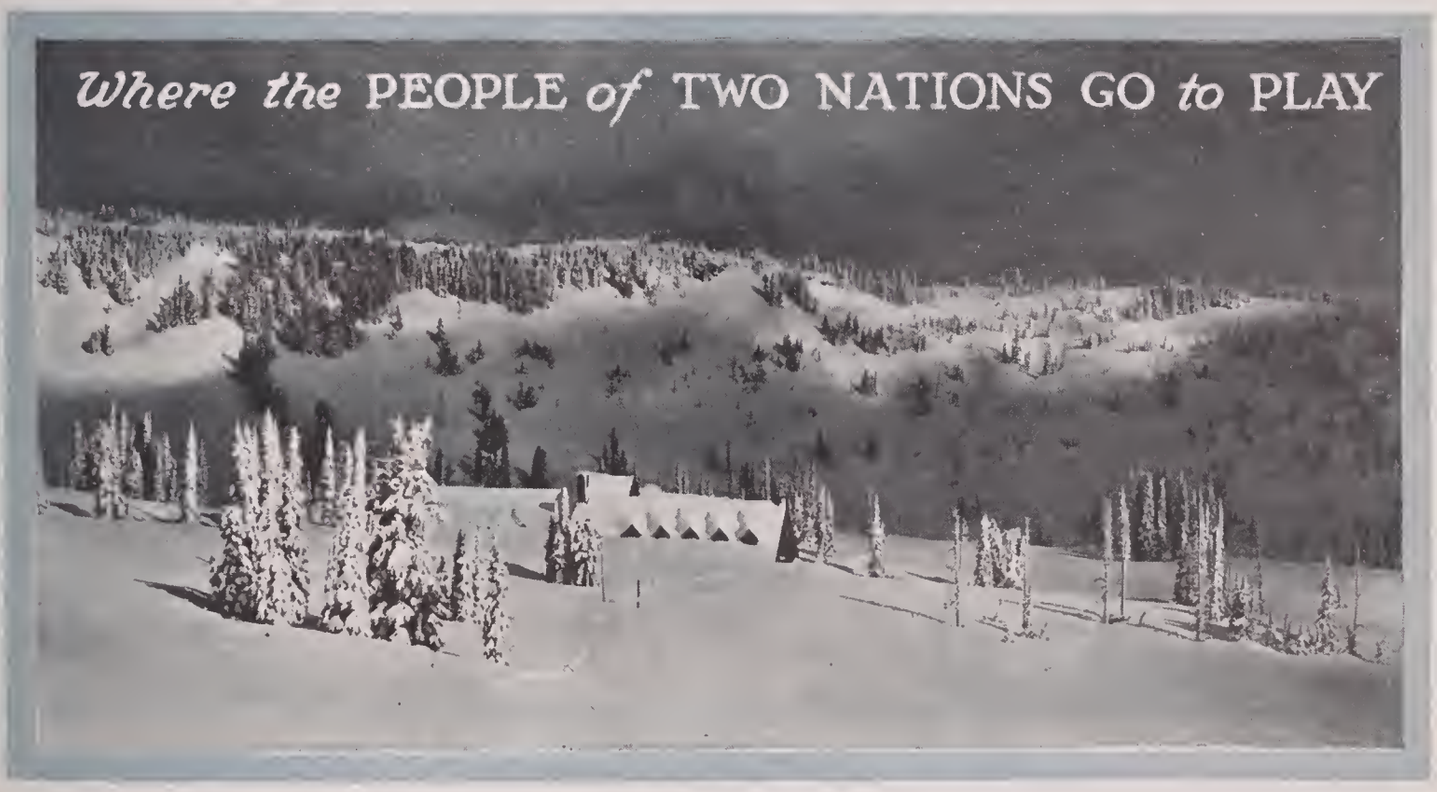
The bright little Nasturtium of the summer garden.

Scientific name, *Tropaeolum majus.* Flowers irregular, spurred, yellow and orange, 5 sepals united at base and on the upper side of the flower, extending into a long, descending spur; corolla 5-petaled, the lower 3 petals fringed at the base while the other two are inserted at the mouth of the spur; 8 unequal stamens; leaves circular and peltate; stem either climbing or creeping.

NATAL (*nȧ-tăl'*), SOUTH AFRICA. A British colony on the southeast coast of Africa, and one of the original provinces of the Union of South Africa. It is rich in minerals, the chief product of the mines being coal. On the coast and in Zululand there are vast plantations of sugar and tea. In the level districts of the interior, where cereals of all kinds (especially maize), fruit, vegetables, etc., grow prolifically, agriculture is an extensive industry. Pietermaritzburg is the capital of the province, and Durban an important port through which passes a large foreign trade. Population, about 1,200,000, of whom about 122,000 are Europeans. (*See* South Africa.)

NATIONAL DEBT. Nations as well as individuals and business concerns often have debts. If an orderly progressive nation has a debt in times of peace it usually means that it has spent large sums of money for improvements to benefit the future generations of citizens. Naturally the government does not wish to burden the present taxpayers with the entire expense; so part of the cost is postponed to a later time—that is, the government borrows money and gives the lenders bonds which show the date on which the money will be repaid, and the amount of interest that will be paid each year to the bondholders. These bonds may run 10, 20, 30 years, or even longer. In the case of a great war the expenses of a nation may be too large to be paid through taxation; or it may be thought no more than right that future citizens should help pay the cost of the war. Hence war loans often make up a large part of national debts.

The national debt of the United States, for example, was increased nearly twenty-five fold (to about 25 billion dollars) by its expenditures during the period of the World War. Previously the United States had a rather small debt as compared with the other great nations, for the Civil War indebtedness of $2,500,000,000 had been largely wiped out. The total debts of the chief nations involved in the World War were 27 billion dollars at the outbreak of the war; at its close the total was about 215 billion. These debts represent a sum six times larger than all the deposits of all the banks in the United States, and twelve times as large as the value of all the gold and silver mined since the beginning of the world. The debts of the chief European nations at the close of the war were: Great Britain, 40 billion dollars; France, 30 billion; Russia, 27 billion; Italy, 12 billion; Germany, 40 billion (not including war indemnities).



NATIONAL PARKS. North America is peculiarly rich in wonderlands of nature, in towering mountain peaks, giant canyons, glaciers, geysers, cascades, forest wilderness, and lakes, rivers, and valleys of indescribable beauty. To preserve the grandest and most beautiful of these regions, together with their historic, prehistoric, or scientific treasures, including wild birds and animals in their natural state, the United States and the Dominion of Canada have set them aside as national parks.

In the United States, the Department of the Interior looks after these national parks, protecting their beauties and providing for the safety and comfort of visitors, who find roads, trails, stages, steamboats, and saddle horses, as well as hotels and comfortable tent-camps. Each year people flock to these parks for "simple life" vacations in such numbers that the money spent on them may be considered one of the best government investments.

The number of national parks grows constantly, multiplying the wealth of natural marvels that will be preserved for future generations. In Yellowstone Park in Wyoming, the largest and most celebrated one, are more geysers than are found in all the rest of the world together. It is also the world's greatest wild animal and bird preserve—a marvelous region of 3,348 square miles, containing petrified forests, boiling springs, and a magic river plunging through a many-colored canyon (*see* Yellowstone National Park). In Yosemite Park in California is an enchanted garden with gigantic waterfalls tumbling from dizzy heights (*see* Yosemite Valley). In Sequoia

WHERE UNCLE SAM'S PLAYGROUNDS ARE SITUATED

This map shows most of the spots the United States government has set aside as playgrounds for its people. The names and locations of the nearest large cities have been included as guides to the position of the parks. The areas so set aside are preserved in their natural state, except for such additions as will promote the comfort and enjoyment of visitors. The parks are carefully watched by special police to insure that nothing is done by visitors to mar their natural beauty. The parks cover an area greater than that of Massachusetts and Delaware combined. They are visited by hundreds of thousands of tourists every year, and hence are an immense factor in promoting the health and contentment of the people.

National Park, also in California, are the oldest trees in the world, thousands of California's giant sequoias, many of them more than ten feet in diameter, and some said to have been 3,000 years old when Christ was born! In Mesa Verde National Park in Colorado are some of the best preserved ruins in America, crumbling cliff dwellings of a forgotten race.

Other imposing wonders are to be found in Wind Cave National Park in South Dakota with its miles and miles of sparkling passages; in that Alpine paradise in northwestern Montana—Glacier National Park (*see* Glacier National Park); in Mount Rainier National Park in Washington with its vast glacier system; in Crater Lake Park, that mysterious "sea of silence" in southwestern Oregon; and in the medicinal waters of Arkansas Hot Springs.

Among other national playgrounds are the Hawaiian Park in the Hawaiian Islands, with its three volcanoes and its lake of blazing lava; the Rocky Mountain Park in the heart of the Colorado Rockies; General Grant Park and Lassen Park, in California; Platt Park in Oklahoma; Casa Grande Park in Arizona; Sully's Hill Park in North Dakota; Lafayette Park, a group of granite mountains in Mount Desert Island off the coast of Maine; the Grand Canyon, Arizona (*see* Grand Canyon); Zion Park, Utah; and the huge Mount McKinley Park in Alaska.

Besides her national parks, the United States has more than 30 "national monuments," where objects of historic or scientific interest on lands owned or controlled by the government are preserved. Among these are the Petrified Forest, Arizona; the Muir Woods of California; and the Rainbow Bridge of Utah.

Canada is no less zealous than the United States in preserving its beautiful scenery. It has more than a dozen national parks which are looked after by the Canadian Department of the Interior. Six of the parks in the wonderful Canadian Rockies cover an area greater than the whole state of Massachusetts. The most noted of these mountain playgrounds is the beautiful Jasper Park, the largest national park in America. Others are Rocky Mountain Park and Glacier Park. Algonquin Park, in Ontario, is a famous summer resort region. The Laurentides National Park and Gaspé Park in Quebec between them cover an area of nearly 5,800 square miles.

For any subject not found in its alphabetical place see information

THE SERENE LAKE AND THE STEAMING GEYSERS

This beautiful crystal-clear lake is situated in southwestern Oregon, high above the surrounding country. It was formed by springs that poured their waters into the crater of an extinct volcano, giving it the name of Crater Lake. It is the deepest body of fresh water on the North American continent—2,001 feet near the center.

These are two geysers in Yellowstone Park, known as the "Constant" and the "Black Growler."

contained in the Easy Reference Fact-Index at the end of this work

UP IN THE SNOWS AND DOWN IN THE DESERT

Few places in the world can boast the varied beauty found in Glacier National Park up near the Canadian border in Montana. Great forests of pine make spots of green against the vivid white of the snow, while lakes like giant mirrors in their calm reflect the serene blue and white of sky and clouds.

In sharp contrast with the cool lake of the north is this marvelous rock sculpturing in the Grand Canyon, down in the Arizona desert.

For any subject not found in its alphabetical place see information

A JEWEL OF THE YOSEMITE

Among the many features which contribute to the grandeur and impressiveness of Yosemite Valley are the Yosemite Falls, where the Yosemite Creek descends 2,500 feet to the valley in three leaps.

contained in the Easy Reference Fact-Index at the end of this work

HYMNS *that* FIRE *the Hearts of* NATIONS

The Spirit of a People Expressed in Their Songs—Origin of the Famous 'Marseillaise' —How England's National Anthem is Echoed in Other Lands—The 'Star Spangled Banner' and the 'Battle Hymn of the Republic'

NATIONAL SONGS. When bands play and people sing on any national holiday or festival, the most prominent place in the program is always given to the national song. Some nations have a national hymn composed especially for such occasions, but often this place of honor is given to an old folk song that has grown with the nation and expresses in melody and words the soul of the people whose love has made it their patriotic song.

Of all national hymns, probably the most widely known is the 'Marseillaise' of France, which dates from the memorable year 1792. The impassioned words and music, from the heart of a young army officer, Rouget de Lisle, sprang into being in a single night. It became the marching song of the men of Marseilles as they pressed northward to save the Revolution, and when they entered Paris they gave it with such fervor that the Parisians were aroused to frenzy. They caught up the song and sent it echoing through the streets of their city on that fateful night when the storming of the royal palace of the Tuileries gave it a baptism of blood. Carlyle has described it as a song "which whole armies will sing with eyes weeping and burning hearts defiant of Death, Despot, and Devil."

The national song whose air has been used more widely than any other is 'God Save the King', the song of Great Britain. All that can certainly be said of its origin is that in its present form it was used in 1745, though both words and music had evolved from earlier forms. The melody, with various appropriate words, has been adopted by Germany, Denmark, Switzerland, and the United States, for 'America', written in 1832 by the Rev. Samuel

ROUGET DE LISLE SINGING THE 'MARSEILLAISE'

The 'Marseillaise', the most famous of all battle hymns, was first sung by its author to a group of friends. Imagine you hear him just beginning. This is the first verse and the refrain translated into English:

Ye sons of France, awake to glory,
Hark, hark what myriads bid you rise!
Your children, wives, and grandsires hoary,
Behold their tears and hear their cries.

Shall hateful tyrants, mischief breeding,
With hireling hosts, a ruffian band,
Affright and desolate the land,
While peace and liberty lie bleeding?

To arms, to arms, ye brave!
Th' avenging sword unsheath!
March on, march on, all hearts resolved
To victory or death.

Francis Smith, is sung to the same tune as 'God Save the King'. Among the national songs of the dominions of the British Empire are 'The Maple Leaf Forever' of Canada, words and music by A. Muir; and 'The Song of Australia', words by Mrs. Carleton, music by Singer. Other outstanding songs of the British Isles are the Irish 'Wearing o' the Green', the Scotch 'Scots wha Hae wi' Wallace Bled', and the Welsh 'Men of Harlech'.

The words of the American 'Star Spangled Banner' were written by Francis Scott Key in an anxious night during the British bombardment of Fort McHenry, near Baltimore, in the war of 1812. Set to the melody of an English song composed some 50 years before, it at once became popular, and has long been officially recognized as the national anthem of the United States.

Some Other American Songs

Many people think the stirring 'Battle Hymn of the Republic' more nearly approaches the standard of a national song. Its words were written by Julia Ward Howe in Civil War days, to the air 'John Brown's Body' which was then the universal favorite with Northern soldiers. This tune is said to have been composed by William Steffe, a Southern composer of Sunday school music, and before the war it was used as a camp-meeting tune in the South. The famous Southern song 'Dixie', on the other hand, originated in the North as a negro minstrel song, in 1859. Its composer was D. D. Emmett.

The earliest of American airs was 'Yankee Doodle', which comes from an old English song applied in derision to the American colonists at the time of the Revolution. Its sharp shrill tune is excellently adapted to the fife and drum, but both music and words lack the dignity of a national song. 'Hail Columbia' was written in 1798 by Joseph Hopkinson, to a tune called 'The President's March' composed by a Philadelphia band director named Fyles in honor of President Washington. It is often used as a national song, as is also the case with 'Columbia the Gem of the Ocean', sung to a tune that is claimed for both England and America.

The Belgian National Air

Belgium has the stirring 'Brabançonne', the music of which by François van Campenhout was written during the uprising of 1830, which gave Belgium independence from Dutch rule. Italy's official national air is the 'Royal Italian March', by G. Gabetti; though equally popular is the famous 'Garibaldi Hymn', by the poet Luigi Mercantini and the bandmaster Oliviere. The former Austrian Empire had a dignified and inspiring national hymn, 'God Preserve the Emperor', the music of which was written by Joseph Haydn. Before the great upheaval of 1919 Germany's rich store of national songs supplied her people with music for all occasions. Of these 'Deutschland über Alles' ('Germany over All') and 'Die Wacht am Rhein' ('The Watch on the Rhine') were popular expressions of patriotism.

All Slavic peoples have a wealth of folk-music. Bohemia's two well-known national songs, 'War-Song of the Hussites' and 'My Fatherland', date back through centuries. Serbia has two national songs, 'Rise, O Serbia', and 'God in His Goodness'. The hymn of old Russia was 'God Protect the Czar', and dates from 1830. The Greek national song 'Sons of Greece, Come Rise' dates from the Greek war for independence of 1821–29.

NATURALIZATION. "I do hereby declare on oath that I will support and defend the Constitution and laws of the United States of America against all enemies, foreign and domestic, and that I will bear true faith and allegiance to the same, so help me God."

In any one of 3,500 court-rooms in the United States these phrases from the oath which marks the final steps in the naturalization process may be heard daily. As Jan or Pietro or Ole or Hans repeats it with upraised hand, it marks a red-letter day in his life. Years before—it may be only five, but is likely to be more—he left his native land and friends to come to America, the land of opportunity. His trials and sufferings have been many, no doubt; for it is a fortunate immigrant who finds it easy to begin life anew, learning an alien tongue and customs differing from his own. Small wonder then that there is a touch of pride in the immigrant's heart and a choking sensation in his throat when at last he is admitted to the rights and duties of citizenship in his adopted land.

Exchanging Countries

It is now possible for an alien to acquire citizenship in any of the civilized nations, with varying degrees of difficulty. In the United States there are three steps in the process. First the foreigner makes his "declaration of intention" to become a citizen; he may make this declaration at any time, but cannot secure what are known as his "first papers" unless he has resided in the United States at least two years. The second step is made when the foreigner has been in the country at least five years, at least two of which have been after making his declaration of intention. At this time he files his petition or application for citizenship. Ninety days later he must appear in the court-room with two witnesses who vouch for the applicant's character and his residence in the United States for the required five years. The applicant must then show to the satisfaction of the judge that he has an understanding of the Constitution and of American political institutions. He must renounce allegiance to all foreign rulers and governments, and must swear to support the Constitution and laws of the United States. All this done, he is a citizen of the United States and his wife and minor children also become citizens. (*See also* Citizenship; Immigration.)

To avoid difficulties with other nations naturalization treaties are in force. Each party to the treaty agrees to recognize naturalizations performed by the other, but a naturalized citizen who returns to his native land for two years is usually presumed to have returned to his former allegiance.

"WHAT'S THAT!"—AN INTERRUPTED MIDNIGHT DRINK

Timid creatures like the deer come to their drinking places at night. This beautiful animal was about to drink at a forest pool when it heard the click of the camera. Just as it looked up startled, the flash light went off and produced this picture.

For any subject not found in its alphabetical place see information

LEARNING *to* READ *in* NATURE'S WONDER BOOK

Have you ever tried " hunting " with a camera? If you want to get close to the great out-of-doors, the camera will give you all the thrills of shooting, and a lasting record of every pleasure as well. As a pastime picture-hunting is unexcelled.

NATURE STUDY. If you were lost in the woods in the day-time could you find the north? Why is the water shallower on the inner side of a bend in a stream? Why does snow fall sometimes in shell-like spirals or whorls around the corner of a building or other solid object? Why, on a cold sunny day, does the snow to the north of an open-barred fence or gate melt in honeycombed slanting ridges instead of subsiding smoothly and evenly like the snow in the open fields? Which birds in your neighborhood stay throughout the winter, and which go South? Do you know when each winter absentee gets back in the spring?

HOW WILD ANIMALS ARE "SNAPPED" AT NIGHT

A bull's-eye lantern is set on the table beside the camera. Its glare attracts the curious forest creatures. The camera shutter is opened, and the flash light the woman is holding in her hand is set off at the proper moment.

When do the first houseflies begin to buzz? When do the horses and other farm animals begin to shed their winter coats? Are potato roots above or below the tubers? Which way does a morning-glory vine turn, to the right or to the left? What does a clover leaf do every night? Does a wood sorrel, which has a similar leaf, do the same thing? Why does the sunshine streaming through the tiny chinks in a closed shutter fall on the floor in round blobs instead of triangular or rectangular patches corresponding to the cracks through which it is admitted? Why are the pebbles in the bed of the brook all rounded? Have you seen rounded pebbles anywhere else? What do they tell you?

SOME PICTURE QUESTIONS FROM NATURE'S BOOK

The Chickadee stays with us all winter. Can you name other common birds which do not migrate? This will be easy if you have kept your eyes open in time of snow and frost.

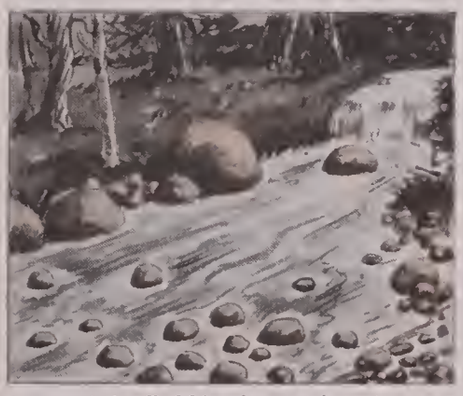
This picture shows you how many blossoms there are in an apple cluster. Do you know how many in a Dogwood cluster? Watch for it the next time you go out in blossom time.

Potatoes are not true roots, but modified underground branches of the plant. They usually grow above the true roots. Do you know how the roots of an Onion grow and how the bulb is formed?

The Morning Glory twines around its support in a direction opposite to the way the thread of a screw runs. Do you happen to know how the stems of the Hop or the Wistaria twine?

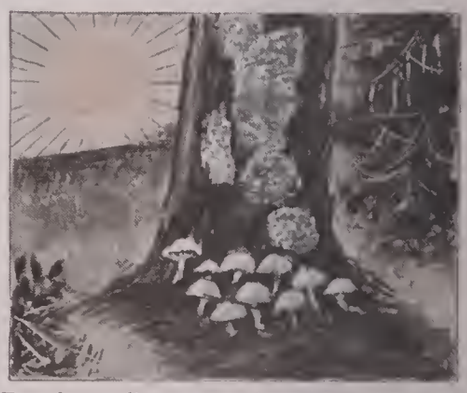
You can tell the difference between a Locust and a Grasshopper by the length of their feelers or antennae. Which is which in this picture? What are the other chief differences?

Most of the flowers that bloom at night dress in white. Why is this? What has that Moth got to do with it? If you look far enough you'll find a reason for every shape and color in nature.



Most of the Pebbles in running streams are round from the rolling action of the water which wears them down. What would you think, if you found a bed of round pebbles on a mountain top?

Trees growing in swamps have to send up their roots above the water to get air. What are some of the swamp trees? Can you recognize this one from the curious "knees" that surround it?



Fungi usually grow only on one side of a tree. Which side is it? What has sunlight and the color of the plants to do with it? Can green plants live always in the dark?

One misses at least three-quarters of the fun of living in this remarkably interesting world if one goes through it blind to the curious and beautiful sights spread out before one's eyes, and deaf to the thousand and one fascinating stories told by every leaf and pebble and feather. Someone tells the story of bewildered tourists (who might far better have stayed at home) going through the Vatican at Rome, identifying the Apollo Belvedere and other masterpieces of ancient art by the labels on the pedestals, and checking each one off in the catalog, without ever once taking the trouble to glance up and see the glorious works themselves. Too many of us go through life very much that way. We look at things just enough to make sure that we fasten the right names to them—that at least we don't call a cat a dog, or mistake a cow for a horse—and there we stop.

In certain orchards the blossoms on some of the branches of the apple trees withered and died while the blossoms of other branches produced fruit. The farmers consulted an agricultural expert to find out what the matter was and what could be done about it. The expert asked what the withered flowers looked like and what could be seen on the branches. What were the symptoms? Nobody had thought to look for any; the flowers had just died, that was all. But,

For any subject not found in its alphabetical place see information

HERE AND THERE IN THE WORLD OF NATURE

This is a group from the great world of animal life, selected at random, but about any one of them a whole book of interesting things might be written. How graceful and agile are those little White-Footed Mice! And how cunning that young Fox looks! Take a good look at the Frog. Does he have webs between all his toes? Even the most adventurous of boys are not inclined to press the acquaintance of the Skunk, but those who have done so find he makes his home in a hole in the ground. Our white-backed friend there is standing up in his home burrow looking about. The Otter, with his broad, stout tail and sinuous body, is a wonderful swimmer and fisherman, changing his course with incredible swiftness as the fish dart here and there to escape.

asked the expert, hadn't they seen the affected limbs? Oh, yes, said the farmers, they had seen them—from the barnyard!

Does such unobservant heedlessness seem absurd? But how many of us show a greater degree of intelligent curiosity in regard to "common things"? Don't we take a day off to go to the zoo or the menagerie, and gape at the lion and the hippopotamus, without realizing that we have at home in the pet kitten a specimen of the genus *Felis* which is just as interesting as a lion or a tiger; and that on any August day we can pick up from the field a far more grotesque monster than the hippopotamus—a grasshopper? When we exclaim in delight at a stereopticon picture of a bamboo jungle in Borneo, do we realize that there is just as wild and beautiful a jungle in the grass-grown fence corner? Perhaps we think we know all about cats, grasshoppers, and grass. Do you know how many toes a cat has on each foot, or how a newly hatched grasshopper differs from a full-grown one?

Nature study is just keeping one's eyes, ears, and mind *open* to the sights and sounds, the facts and the fascinating puzzles, of the natural world. Anyone who lives in the country is fortunately placed for such study. But there are few places from which Nature is entirely shut out; and wherever winds blow, sun and stars shine, snow and rain falls, weeds grow, and flies and wasps buzz, there are the materials for studying Nature.

THEY'RE NOT AFRAID OF THE CAMERA

The mother Cat-bird and her two young ones have settled down in the very place where the camera can't photograph them. It took another camera to get this picture. What do you suppose those young ones are saying? Perhaps they are trying to pronounce their scientific name *Galeoscoptes carolinensis.*

Microscopes, field-glasses, and other tools of science are helpful things, but anyone with two good eyes and really intelligent curiosity about the world may be fortunate enough to make a real discovery. A little girl noticed that grasshoppers in great numbers would jump on her white dress, while they did not seem to be attracted by her colored dresses. She asked her teacher why grasshoppers like white. He did not know, and sent the query on to an eminent entomologist, who replied that he had never known that grasshoppers showed such preference, and that the little girl had made an important observation, which would have to be followed up.

One need not stir from home to find opportunities for studying Nature. The great French naturalist Fabre, who made the stories of the ants, the bees, the wasps, and the beetles more interesting than most novels, for 30 years never left his little farm, which was too small and too poor to be good for much else than his beloved insects (*see* Fabre, Jean-Henri).

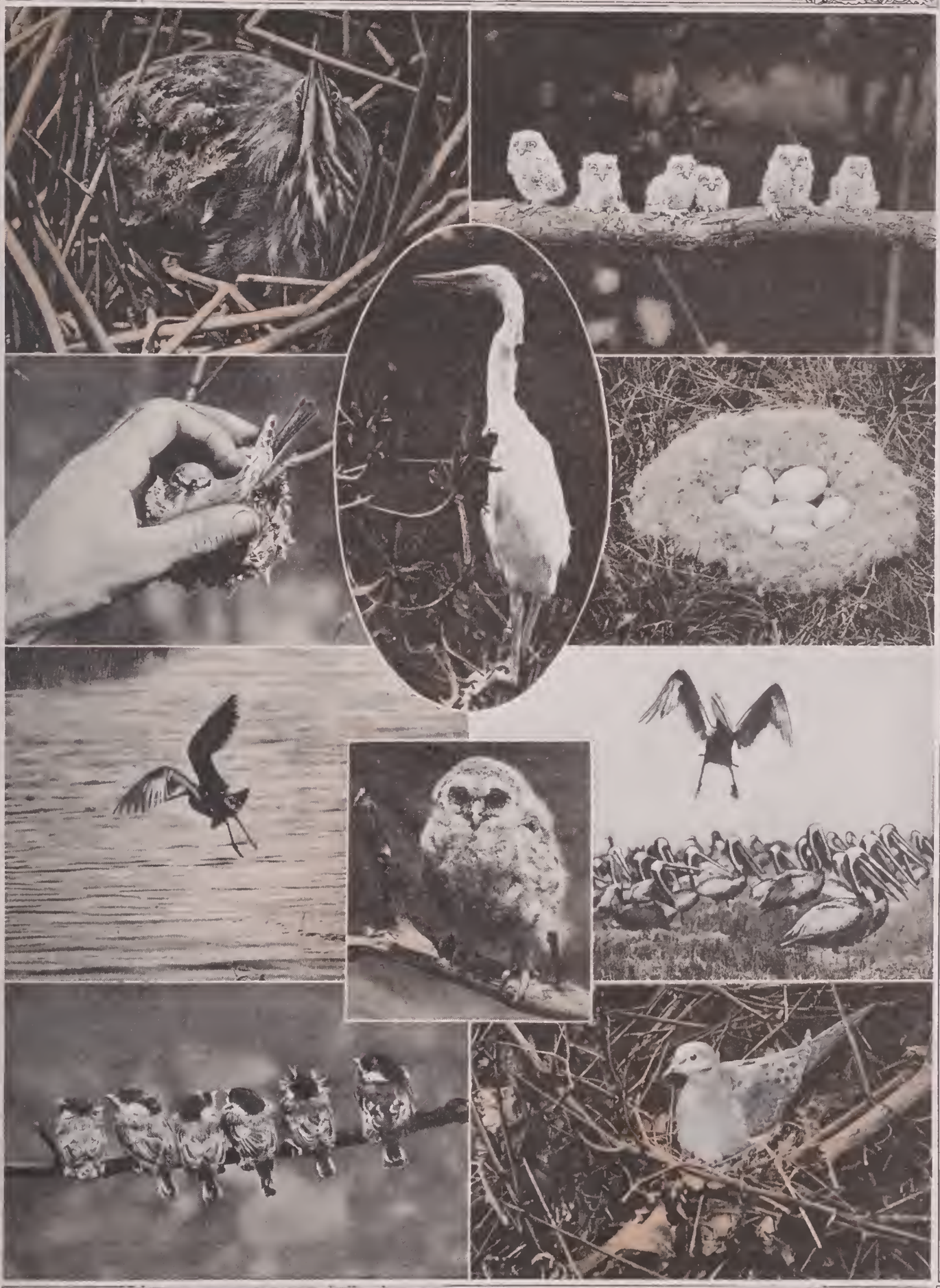
Books are helpful, and some "Nature books" are among the most delightful contributions to literature. Anyone who becomes deeply interested in any phase of Nature will want to know what has been written about it. But the real textbook is Nature herself.

How can one begin? "Stop, look, and listen" — and think; that is the

HOW MRS. KILLDEER TAKES HER OWN PICTURE

The way the bird is made to take her own picture is ingenious. Two sticks are driven down on each side of her nest. A string is tied to one stick and passed around the second stick, extending to the trigger of a spring-wire mouse trap that is fastened rigidly to the ground. The shutter release on the camera is fastened to the U-shaped wire of the trap. When Mrs. Killdeer alights on the nest, she pushes down on the string, giving it a gentle pull which draws the trigger of the trap and sets free the powerful U-spring, which in turn pulls the shutter and takes the picture.

PICTURES FROM A NATURE LOVER'S ALBUM



Here are ten interesting snapshots from the collection of a naturalist: A Bittern on her nest; six young Screech Owls; a Blue Vireo on her nest; young Great White Heron, almost ready to fly; Wild Goose's nest, with its lining of down; a Godwit (a member of the snipe family), at the beginning of its flight; a young Barred Owl; a colony of Brown Pelicans; six baby Chickadees; and a Mourning Dove on her nest.

contained in the Easy Reference Fact-Index at the end of this work

THE STORY OF THE CAT AND THE FLYCATCHER

Little Mother Flycatcher had moved in where a Woodpecker had moved out, had made her nest interwoven with a dried snakeskin, after the manner of her people, and had hatched her little brood. Along came that cat, climbing clear up to the nest, although it was six feet above the ground, and poked in her head with the idea of eating the little Flycatchers. But Mother was on the nest and she pecked at that cat's eyes with her bill, and beat it in the face with her wings, so that it backed out as fast as it could and went scampering down the tree. Then little Mother Flycatcher started out to get something for the family supper.

essential thing. You might find it interesting to keep a calendar of Nature happenings, as did Thoreau, who "kept an account of the flowering day of plants as a banker does of the day when his notes fall due," and who believed that if he were waked up out of a trance in his familiar swamp he could tell by the plants what time of year it was within a few days. If you become especially interested in birds or butterflies or flowers or ferns, or anything else, you will want to "camp on the trail" of the creature or plant until you have learned all you can about it.

In September or October there are many interesting and instructive features of plant life which furnish the material in sufficient variety for several lessons; the more common autumn fruits of the locality, wild and cultivated, with a study of their form, texture, flavor, name, and use; the autumn leaves and flowers, with a study of their form, color, etc.; the autumn seeds, their forms, methods of distribution by winds, by animals, by water. The animal life of these months is full of interest for young and old. The birds which have summered in the locality are going South and others with strange plumage are coming from the North on their way farther south or to spend the winter here. Insects are gradually disappearing in a variety of ways, some going into winter quarters to appear in new forms in the spring, others hiding away in the trees, in the earth, or elsewhere, while countless multitudes deposit their eggs and die. The thickening of the coats of the wild and domestic animals should be carefully observed now and in the month following. Clouds, rain, dew, frost, changes in temperature, direction of the wind, will interest the child every month in the year.

For any subject not found in its alphabetical place see information

WATCHING THE BUCKEYE GROW DAY BY DAY

1. The bud on the first day of its opening. 2. Sixth day, more inner scales break away. 3. Eighth day, the last and innermost scales are rapidly pushed away. 4. Ninth day, the leaf is exposed to view.

5. On the eleventh day the leaflet becomes detached. 6. Three weeks later, the leaves have assumed their proper shape and the flower buds have sprouted. 7. Fifteen days later the flower opens.

In November and December Nature study finds ample outdoor range in discovering how the plants have prepared for winter, how the buds are sealed up, where the leaves have gone, what animals still remain in the locality and how they live, what the streams are doing, where the fish and other water animals have gone, what the farmers are doing. They also are good months for studying further the collections of fruits, seeds, leaves, grasses made in other months. Why are the days so short now? Why is the sun so far south?

The weather is a fruitful theme during January, February, and March, but there is much also to engage attention in the lines mentioned for the preceding months. A simple study of the forms and modes of movement of domestic and of wild animals will make a few attractive lessons. These are good months for the study of the various forms of water and for making simple experiments in light, heat, electricity. Note later the signs of springtime in the growing length of the days, in the disappearance of frost and snow, in the swelling and opening of certain kinds of buds, in the flowing of the sap in the trees, in the appearance of an occasional last year's animal, in the song of the robin or the quick cry of the redbird, in the buzzing of venturesome bees, in the work about house and farm.

April, May, and June conspire to furnish a world of material to attract and interest childhood. The studies should include the germination of seeds, the

unfolding of leaves, the opening of the flowers; the parts of the plant, of the leaves, and of the flowers; the various animals that cover the earth and skim the air; the molting of the birds; the metamorphosis of the grasshopper, the butterfly, the frog; the building of nests; the swarming of the bees; animal foods. They should also include all kinds of work about farm and home and keep the child in close touch with ploughing time and seed time and harvest; with the pests the farmer fears; and with the friends he should protect.

THE SQUIRREL AS A PHOTOGRAPHER

You fix a nut on the end of a string, attach it to the shutter of a camera like that, and Mr. Squirrel does the rest, as you see in the top picture. A similar device will take him standing on his hind legs, as in the second picture.

July and August, as well as a great part of June, are months in which the child is usually out of school, but if the teaching during the other months is successful, these months also will have much in experiences upon which he will find pleasure in drawing as school opens in September.

If you are lucky enough to possess a camera you will find "camera hunting" one of the most fascinating of pursuits. More and more sportsmen are coming to realize that they can substitute the camera for the gun and enjoy all the pleasures of the chase without leaving the world poorer by the annihilation of the little people of field and forest. One camera enthusiast says: "Every camera hunter must admit that more immediate and lasting pleasure is afforded in raking a running deer from stem to stern at twenty yards with his 5x7 bore camera than in driving an ounce ball through his heart at 100 yards. Then think of the unlimited freedom of this noiseless weapon. No closed season, no restriction in numbers or methods of transportation, no posted land; but you can pull on a swimming deer or an elk floundering in the snow, take a crack at a spotted fawn, bag the bird on its nest or string your cameras out like traps, with a thread across the runway, and gather in the exposed, game-laden plates at nightfall without any scruples about being called a pot-hunter or a game-hog." In introducing a book of wild life illustrated with the camera President Roosevelt wrote: "The older I grow, the less I care to shoot anything but 'varmints'. If we can only get the camera in place of the gun and have the sportsman sunk somewhat in the naturalist and the lover of wild things, the next generation will see an immense change for the better in the life of our woods and waters."

This use of the camera has proved of distinct value in aid of Nature study, providing the means of gaining a clear and intimate knowledge of wild animals, birds, and reptiles, their appearance, their haunts, their habits, and all the phases and conditions of their life. Moreover, the young are thus enabled to become direct observers and students of animated nature; for not only have naturalists brought from the Rockies, from the forests and waters of Canada, and from the shores and everglades of Florida the trophies of their skill and patience in a wealth of photographic pictures, but amateurs, even schoolboys and girls, have become expert in securing photographs of the more familiar birds and animals to be found in field and forest accessible to every village and town. Stalking a bird, a rabbit, a squirrel, or a gopher, is an experience full of interest. You will come to note in what surroundings the bird or animal is found, what it is doing, if feeding what sort of food it is eating, the place and character of its nest or burrow. The pictures when developed recall these details and fix them in the mind, and thus you become possessed of a fund of valuable information obtained at first hand, and as your experience grows you can attempt more difficult feats. The mature lad will give zest to his vacations and holidays by becoming a hunter of wild life with camera and flashlight.

Thrilling are the experiences and splendid the rewards of one who hunts with a camera.

For any subject not found in its alphabetical place see information

SOME OF THE WAYS OF RABBITS AND SQUIRRELS

See how Mrs. Rabbit has lined the home of her babies with fur—and it was her own fur, too. While most rabbits live in burrows in the ground, thus differing from the hares, this family has contented itself with a place hollowed out in the thick grass.

"Do you know what we have these lovely tails for?" we can imagine these dear little fellows saying. "We do. We use them to help hold us up when we are taking those long jumps from limb to limb in the trees. They help us keep our balance, like the tail of a kite. Then, when we get big, by the time cold weather comes, we wrap them around our feet to keep them warm when we cuddle up to sleep, and poke our noses under them, as little human folks put their noses under the blanket on cold nights."

contained in the Easy Reference Fact-Index at the end of this work

A Wild Garden and Its Tenants

THIS is the story of a wild garden that was found near a public school on the edge of a big city. None of the children had the tiniest garden, and they were not allowed to pick flowers in the parks, even to use in the schoolroom for nature study. So this wild garden, where they could pick armfuls of flowers, where they could pull plants up by the roots, where they could gather seed-cases and cocoons, and watch insects at work, was a wonder and a delight.

Even the teachers did not know it was a garden, at first. It was a vacant block of land 200 feet square. All around it ran a new cement walk. The ground was two or three feet below the level of the street and would cost a good deal to fill in. Perhaps that was why there were no houses on it. The soil was very poor. From the walks the earth crumbled away in steep banks of gravel, sand, and yellow clay. Water lay in sunken places, making frozen ponds for sliding in winter. There was a fallen tree-trunk and two or three rotting stumps of scrub oaks, around which mosses and low ferns grew. In the spring the ground was boggy, and scantily covered with ragged weeds and wire-grass. Strips of blue-grass turf below the walk were dotted with the golden heads of the dandelion. In the wettest places a few clumps of blue flag lilies and pussy-willow bushes were found. Along one bank were brambles that in June blossomed with the single pink flowers of the wild rose. And there were clover blossoms.

WORLD-WIDE "SKIPPERS"

Wherever in the world this Skipper Butterfly might go, he would meet relations, for the Skippers are found everywhere. Small brown things they are, and you may know them from their short jerky flights. That's how they got their nickname. He's shown here resting on the tip of a Plantain weed.

The Wild Garden in Autumn

But that was all. When school closed in June the lot was covered with tall, coarse, ill-smelling weeds that gave no promise of flowers. But when school opened in September the place was a jungle of purple and yellow, with swarms of winged visitors.

On the strip of green sod under the edge of the walks the dandelions still showed bud and blossom and gauzy seed globe. But they did not take all the space. The grass was thick with the trefoil leaves and round buttons of white clover. And here and there was the glossy-leafed pink-flowered spike of smartweed. Clambering up the bank grew a strong rough-stemmed little vine, with leaves like a wild strawberry. At every twisted whorl of leaves was a tiny starlike flower, as yellow as a buttercup. It was the "cinquefoil" (meaning "five-leafed"), a weed which really is a far-away cousin of the strawberry. Among the cinquefoil were clumps of mint. Their long hairy stems and fuzzy leaves were topped with frowzy heads of lavender-pink fringed with silver, and breathing forth spicy smells. In every corner and in many a crack of the sloping bank stout burdocks were rooted. The purple-topped green burs in heavy knots leaned out over the walk to catch in the clothing of passers-by.

Farther afield tall thistles lifted royal purple heads crowned with plush. They had a soldier guard of sharp lances and spears, set on stem and leaf and flower. But, unafraid, wild morning-glory vines twined around their spiny columns and hung out delicate pink and red and white flower bells. The morning-glories also clambered up the dusty stalks, and bloomed among the small pale yellow flowers of the mulleins.

The Four Varieties of Clover

In that wild garden were four varieties of clover—the white creeping clover of blue-grass lawns; the pinkish purple-headed clover of farm meadows; the tall shrublike sweet clover, with tassel blossoms of white, and a blood-red clover with pointed heads like pine cones. The crimson clover is a foreigner. Grown all over Europe, it is not often seen in America. In that wild garden it was a well-born emigrant among rough and hardy American weeds.

Except for the clovers, the smartweed, the morning-glories, the white parasols of tansy, the mint, and a few fiery spikes of the cardinal flower, the garden was a haze of yellow, spotted with purple. The long plumes of the golden-rod made a background for

everything else. Against its feathery masses were set the dazzling yellow of the field sunflowers and black-eyed Susans. Much of the mustard had gone to seed. The tall plants were hung with tiny green pods, but there were still some clusters of yellow cross-shaped flowers left hanging to them.

Lower down, hidden in wire-grass, was yellow-flowered sorrel with acid leaves that the children liked to nibble. There was many a sturdy bunch of "butter-and-eggs" with cream-and-gold lipped and spurred blossoms set on spikes, the country cousin of the snap-dragons of old-fashioned gardens. There were seed spikes and broad leaves of dock and plantain; the peppery seed sprays of the tongue grass, that gave a feast to all the pet canaries in the neighborhood; and the catnip mint that made pet pussies go into spasms of delight. But these plants only added to the green of the leaves. The purple notes in the riot of yellow were given by the royal heads of the thistles, the reddish-purple spikes of the iron weed, and the violet-and-lavender ray-flowered clusters of wild asters.

THE DANDELION'S "CHILDREN"

The Dandelion floats its seeds away when they are ripe on tiny parachutes of down. This picture shows a ripened dandelion, somewhat enlarged, with the seeds ready for their first trip into the world. Notice that in addition to the white parachutes, the seeds have sharp little claws with which to cling to the ground when they alight, and so bring their travels to an end.

For several days the children were puzzled by an odor as sweet as that of lilies of the valley. It could be smelled only at night, when the garden lay dim and dewy under the moonlight. The perfume was traced to weedy stalks with small green-sheathed buds. They were not noticed by day, but opened pale yellow five-petaled rose-shaped flowers after nightfall. It was the evening primrose, that grew in the shelter of dense thickets of goldenrod and asters. Big moths visited the primrose by night. In the daytime the shriveled blooms held drops of honey so sweet that wasps with steel-blue wings passed by all the open flowers to drink the delicious primrose nectar.

Above the whole field insects were always on the wing. A little white butterfly was fond of the purple thistle. Bumblebees visited the thistles, the field clover, and the butter-and-eggs. It was very funny to see a heavy buzzing black-and-yellow bumblebee drop on the lower lip of a butter-and-egg blossom, tip it down, and force his greedy head into the long honey-filled spur. Little honey-bees liked the white clover best. The goldenrod plumes, when in full blossom and gold-dusted with pollen, were always spotted with little black beetles that could scarcely be shaken off. This same little jetty beetle was very fond of the dandelion pollen, too.

Gauze-winged dragon flies darted here and there; grasshoppers by hundreds leaped and clicked their wings; and robins and jay-birds from a nearby park made raids on the grasshoppers. A dozen varieties of butter-flies were seen by day, and many a moth by night. On every dewy morning the webs of spiders were strung with diamonds. The caterpillars had spun their cocoons on the stoutest of the weed-stalks, and flies grew sluggish in the cool nights. In dry places and between the cracks of the walks were little domes of sand, honey-combed with tiny holes. These were doors to underground houses of red and black ants.

Soon there were many seeds flying about—seeds of the dandelion, the thistle, the goldenrod, the milk-weed. There were seeds with tails and wings and gauzy sails, and hooks and bursting pods. Every breeze loosened and scattered them. When frost came and killed the blossoms, the garden was a feeding ground for many birds.

One sunny day of Indian summer, late in October, some boys digging for pupas of beetles that had gone to sleep in the ground found a nest of field mice, and caught a glimpse of a chipmunk on a stump. The school was wild about the discovery. So the teachers got books and pictures, and a dozen rooms were busy for a month studying and writing stories about chipmunks and ground and tree squirrels.

The wild garden furnished this school with living things for nature study all the year around, in plants and insects. Don't you want to know some of the things they found out? You can find most of these plants and insects by many a wayside in the country, and on vacant lots in cities. And you can learn about them by looking up their names in this book.

contained in the Easy Reference Fact-Index at the end of this work

NAU'TILUS. Every schoolboy knows Oliver Wendell Holmes' poem 'The Chambered Nautilus', in which he says—

This is the ship of pearl, which, poets feign,
Sails the unshadowed main,—
The venturous bark that flings
On the sweet summer wind its purpled wings.

But few people know anything definite of the animal about which the poet writes so beautifully.

A "child of the wandering sea," as Dr. Holmes called it, the nautilus lives in the warm waters of the Indian and Pacific oceans, where four species are known. The "ship of pearl" is the shell; the "mansions" are the chambers of the shell, which are made or secreted by the tissues of the animal.

At first the creature lives in a single nearly cylindrical chamber. As it grows, a new chamber is secreted and a partition made between this and the old one. The animal slips forward into the new chamber, leaving behind it only a narrow cord, the "siphuncle," formed from the tissues of the "mantle" of the nautilus. A large number of chambers are formed in the same way, the animal moving forward each time, until a stage is reached when no more chambers form. All the chambers are air-tight cavities filled with a nitrogenous gas, and the siphuncle extends through all the chambers into the one first formed. The chambers do not communicate with one another. The living animal cannot ordinarily rise to the surface of the water, but the shell is often found floating after its occupant dies.

THE NAUTILUS IN HIS SHELL

This picture shows the nautilus folded up in the front of his shell, part of which has been cut away so that you can see the structure. At the bottom are the scores of small tentacles, with which the animal catches its food.

The natural position of the nautilus is with the head downward, tentacles spread out, and shell vertical. Nearly a hundred small tentacles, with which its food is caught, are placed on the area surrounding the mouth. None of the tentacles have suckers, but each can be withdrawn into a sheath. When the tentacles are expanded, the head of the animal looks like the open disk of a sea-anemone.

The nautilus is a mollusk of the group called cephalopods. It is peculiar among cephalopods, however, in possessing four gills, the others having only two. Its eyes also are remarkable, for they are constructed on the principle of the "pin-hole camera." The eyes of no other animal are so constructed. They have been described as slightly projecting hemispherical boxes, like kettle drums, a half-inch in diameter. The covering of the eye is not transparent, but like that of the head; in the middle of the structure is a minute hole which permits sea water to enter and fill the eye.

In general appearance and in structure the nautilus resembles its relatives, the octopus, the squid, and the argonaut. In literature, and even in the accounts of naturalists, it is often confused with the argonaut.

HOW THE CHAMBERS ARE ARRANGED

This nautilus shell has been cut in two to show the curious chambered structure. As the creature grows it keeps moving to the front of its shell, sealing up one chamber after another behind it.

NAVAL ACADEMY, UNITED STATES. The waters of Chesapeake Bay frolic under the moonlight as they wash the sea wall fringing the great campus of the United States Naval Academy at Annapolis. From across the bay Maryland's summer breathes forth fragrance. The rows of massive gray buildings loom in dark outline against the sky, and the illuminated face of the clock in the old tower beams moonlike through the gnarled branches of venerable trees. It is "June week" at the Naval Academy, where Uncle Sam trains young men to be naval officers, and this is graduation week, dear to all midshipmen.

From your place in the center of the quadrangle, you see the "middies" everywhere. Most of them, in the regular uniform of navy blue, are hurrying past you to the farewell "hop" in the vast gymnasium to the left of Bancroft Hall. You also see cadets, as the midshipmen are still frequently called, strolling along the Severn River docks to your left, where the masts of many little sailboats loom like a tiny forest against the horizon. The administration building lies to your

WHERE UNCLE SAM MAKES OFFICERS FOR THE NAVY

An airplane camera took this view of the Naval Academy at Annapolis. The large building in the foreground is the midshipmen's living quarters, flanked by the Armory and the Gymnasium. The central building in the back row is the Academic Building, with the Chemistry and Marine Engineering buildings on either side. The building with the dome is the Chapel.

right, and also the chapel, where John Paul Jones is buried. Behind you are the academic and the marine engineering buildings. The total number of midshipmen is about 2,000.

The life of these youths, upon whom the future of the navy depends, is much more strenuous than that of the average university student, and the course of study they must pursue is more rigorous than that of any other college in the country except West Point. Rising at six with the reveille gun, they have about 40 minutes to dress, form in ranks, and march to breakfast. Afterward they must make their beds and clean their rooms. Alternate study and recitation periods precede lunch and follow it, until the late afternoon drill period. After the march to dinner there is a long study period, with "taps" or "lights out!" at ten.

In their first year at the Academy, these youths—as "plebes"—start the rigid drills which continue throughout the eight months of each academic year—rowing, sailing, infantry, artillery, boxing, dancing, fencing, and swimming. They study mathematics, English, Spanish or French, and mechanical drawing. The next year—as "youngsters"—they go further into these studies, adding naval history, electrical engineering, and physics. During their third and fourth years they continue to study the languages, and take up advanced subjects---such as seamanship, ordnance, naval construction, and navigation. At the end of each of the first three academic years, about June 1, they have three months' practice cruise and a month's vacation. At the end of the four years' course, those who have measured up to the strict standards of discipline and to all the high requirements as to scholarship, officer-like conduct, and physical fitness are graduated as ensigns—the first rung of the ladder of naval promotion.

TEN RULES FOR MIDSHIPMEN

The superintendent of the Naval Academy gives the following ten rules designed to meet the needs of lads in the naval service:

Do your day's work every day.
Strive to make 100 per cent in everything you undertake.
Obey orders cheerfully, honestly, and conscientiously.
Do your full duty on time, all the time.
Practice self-control and self-denial.
Be considerate of others. Be helpful and cheerful and courteous.
Don't be a "growler" or a "sea-lawyer" or a "drifter" or a "dud."
Be true to yourself, to your mess-mates, to your task
Be true to the great naval service to which it is your priceless privilege to belong.
Always steer a straight course and answer with a cheerful "Aye, aye, sir!"
Be a man and never say die.

Five midshipmen are allowed for each senator, representative, delegate in Congress, and the Resident Commissioner from Porto Rico, and five also from the District of Columbia. Fifteen are appointed by the president every year from the United States at large. Provision is also made for 100 annual appointments from the enlisted men of the navy. To qualify for entrance, candidates must pass exacting physical tests, and mental examinations requiring the equivalent of a first-class high school education, or present satisfactory certificates of graduation from accepted secondary schools. The entrance age is 16 to 20. Midshipmen are paid by the government at the rate of $780 a year, but much of this is used to defray expenses.

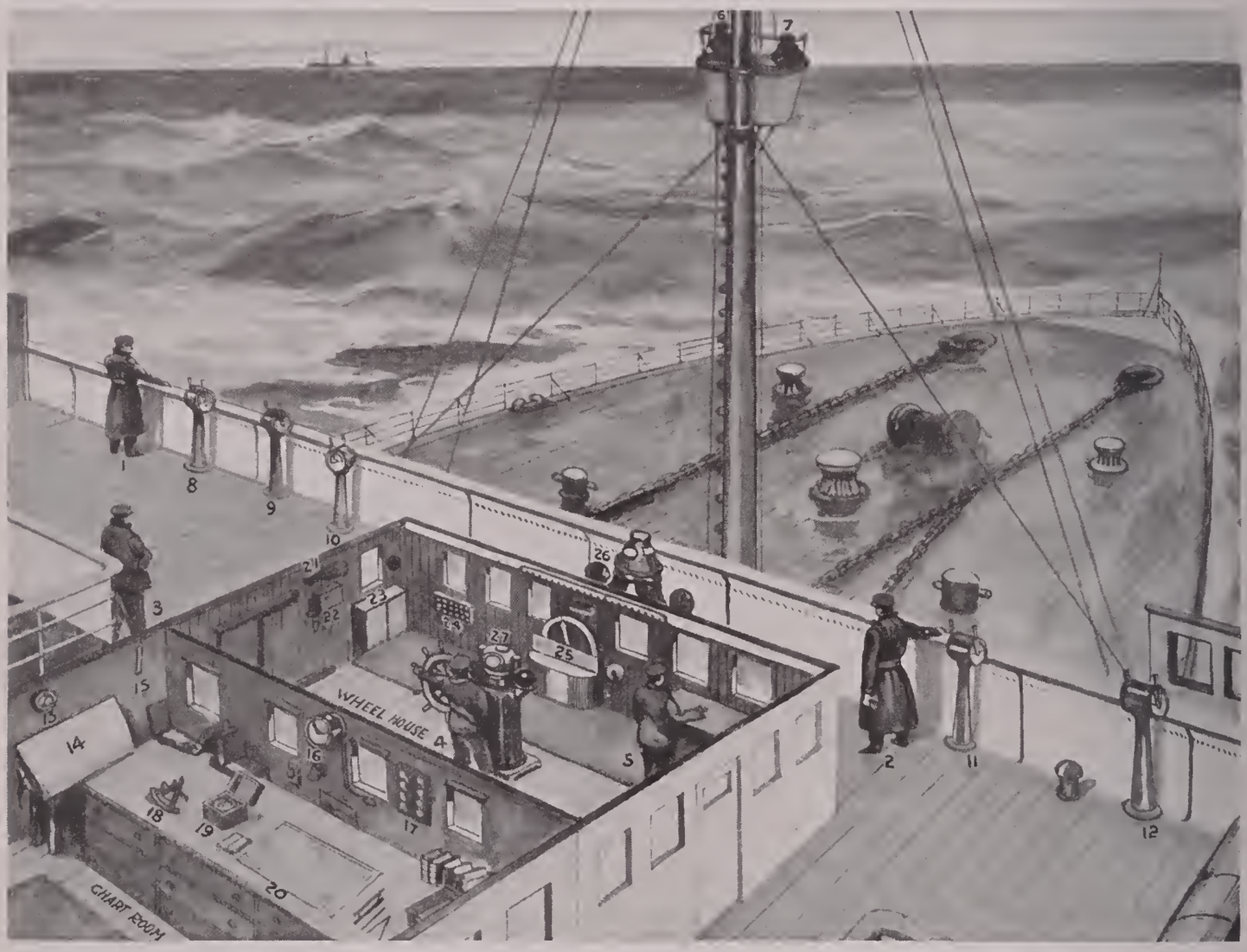
NAVIGATION. How does the navigator find his way across the trackless ocean, out of sight of land for perhaps weeks or months at a time? Maps and charts tell him the position of the port he has left and the port he wishes to reach; and on a perfectly calm sea it would be possible to steer his course with simply a compass to guide him. But ocean currents and strong winds deflect the ship from its course; and it is necessary to re-determine its position (that is, its latitude and longitude) from time to time—preferably once a day.

This determination of latitude can be arrived at accurately by astronomical observations—generally of the sun, but also of the fixed stars. The chief instrument now used is the sextant, a contrivance for measuring the altitude (distance above the horizon) of the sun or any other heavenly body. The sun is not equally high in different latitudes; and by measuring how high it is on any particular date at noon, making allowance for the season, the navigator can compute by means of an almanac how far he is from the Equator. Longitude is found by comparing the local time of the ship determined by the sun, with the time at Greenwich. Greenwich time is kept on board every ship by a chronometer, a delicate timekeeper of the highest attainable precision, suspended so as to keep its face horizontal in spite of the movements of the ship. (*See* Latitude and Longitude.)

When the weather does not permit astronomical observations, the position of the ship may be found by "dead reckoning." The navigator knows by his last astronomic observation where his ship was at a certain time before; by means of his compass he has kept a record of the direction in which he has steered; and by means of a "log" dragged through the water he can learn the approximate speed at which he has traveled. From these data he can calculate the approximate location of the point he has reached. (*See* Log, Ship's; Maps.)

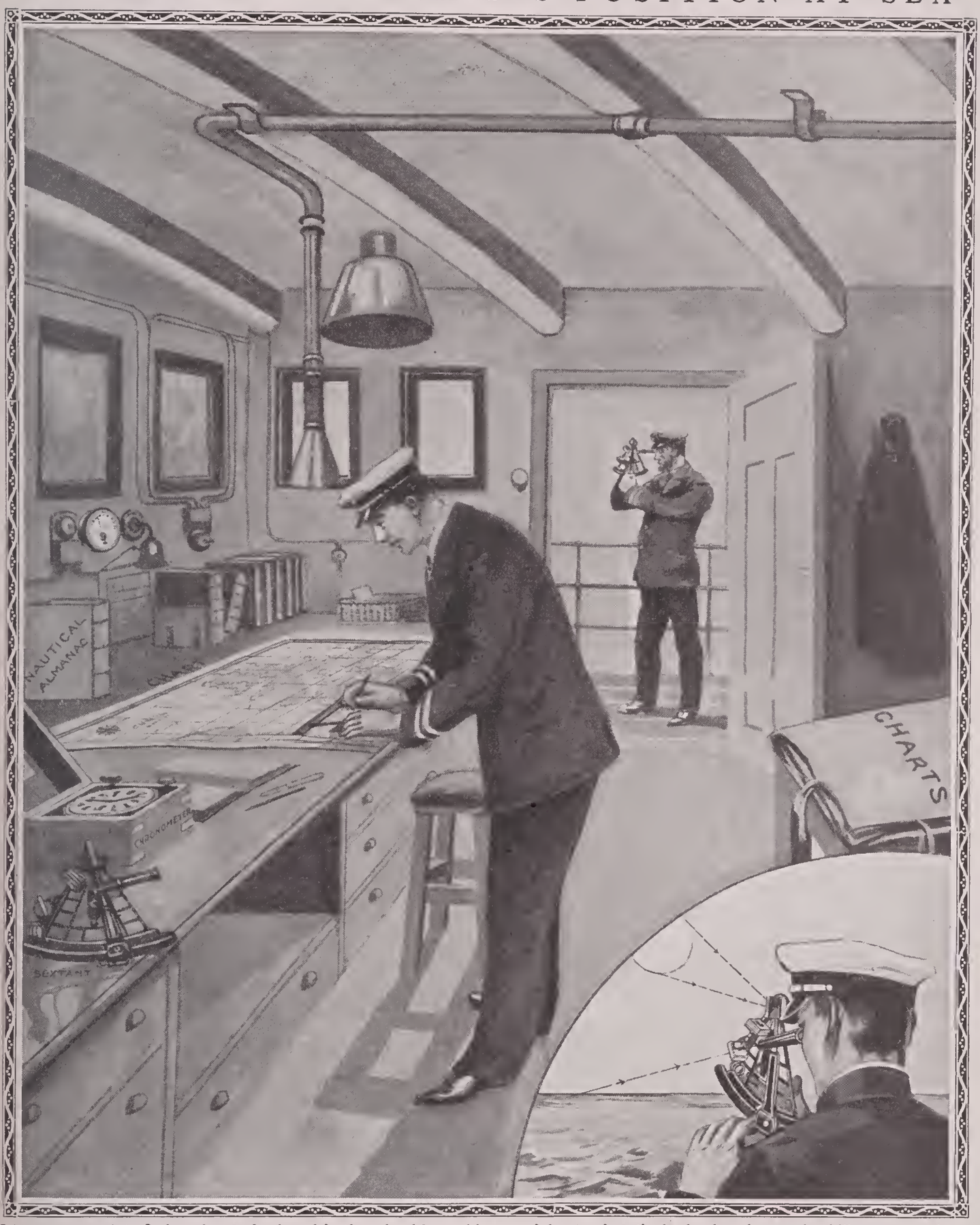
In the early days of ships, mariners were obliged to keep near the land, or occasionally for short distances to depend upon the sun and stars to guide them; but

HOW SHIPS FIND THEIR WAY ACROSS THE PATHLESS DEEP



On a big ocean liner it requires seven men just to see that the vessel keeps on her chosen way. These seven men are: Fourth Officer (1), Chief Officer of the Watch (2), Relief Quartermaster (3), Quartermaster at the Wheel (4), Bridge Ordinary Seaman (5), and the two men always on duty in the Crow's Nest (6 and 7). Figures 8 to 12 show apparatus for signaling the engine room and other parts of the ship in docking and maneuvering. In the chart room, more fully described on the opposite page, are: the barometer (13), portfolio of charts (14), thermometer (15), clock (16), bridge switchboard (17), sextant (18), chronometer (19), and chart in use (20). In the wheel house are the megaphone (21), submarine signaling receivers (22), signal locker (23), the tell-tale which shows the position of the rudder (24), device for governing steering engine (25), and binnacles containing compasses (26 and 27).

WORKING OUT A SHIP'S POSITION AT SEA



It's easy enough to find one's way back and forth on land by making careful note of particular landmarks—rocks, hills, trees, ravines, and so on—but how can the captain tell in what part of the vast stretch of waters he is, with no "landmarks" in sight except the waves, and these looking all alike and never holding still? Yet getting your bearings on the wide seas is by far the simpler thing of the two—when you know how! All you have to do is to take the sextant, get the angle of the sun from the horizon at noon, and then by a simple calculation, worked out with the aid of tables in the Nautical Almanac, find the exact latitude. Longitude you get by comparing the local time of the ship, as determined by the sun, with Greenwich time, shown by the chronometer, and so you can tell the position of your ship within a mile. The smaller picture shows in detail how the sextant works. The swinging arm by the man's left hand bears a mirror on its upper end. This mirror reflects the image of the sun through colored screens to a lower mirror, which reflects it through the telescope to the eye. This second mirror is of a special sort that permits the horizon to be seen. The observer moves the arm until he brings the "reflected sun" to the horizon, and then takes his reading from the graduated arc over which the lower part of the arm has moved.

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as these could only avail them in clear weather, the voyagers often became hopelessly confused as to their position. At the time of Columbus sailors had the compass, then a comparatively recent invention (*see* Compass, Magnetic); but his only means of determining latitude was by a rude instrument called the "cross-staff" or by the "astrolobe." The cross-staff consisted of two pieces of wood fastened together cross-wise so that one would slide up and down upon the other, and so measure the angle of the sun above the horizon, from which the approximate latitude could be determined. The astrolobe was a similar but more accurate instrument.

Working out a ship's position and determining its course requires long and intricate calculations, even with the many aids available today. Several methods of sailing are in use, of which the most important is "great circle sailing." This rests on the fact that the shortest distance between any two points on the earth's surface lies along the arc of the "great circle" connecting the two points. A great circle is one drawn about the center of the earth, forming, so to speak, an "equator" through the points in question. It follows that, unless both points lie on the true equator or on the same meridian, the great circle course will not coincide with the compass course.

GRIM GUARDIANS *of the* SEAS

THE world's police of the seas in normal times, navies in time of war can change the destinies of nations; for the maxim still holds true that "Sea power is the key to empire." What sea power did in the World War, and the types of vessels of which the world's navies are today composed, are indicated in this article; together with the organization and strength of the United States navy, and the history of warship construction from the far-off days of the Greek victory at Salamis to now.

NAVY. Few people realized during the World War the magnitude of the work that was daily being accomplished by the navies of Great Britain and her associates. Land conflicts command more attention, partly because more men are engaged and the encounters are more bloody; but sea power, in the classic words of Admiral Mahan of the United States Navy, acts with a "noiseless, steady, exhausting pressure, cutting off the resources of the enemy while maintaining its own, supporting wars in scenes where it does not appear itself, or appears only in the background, and striking open blows only at rare intervals." It is only in these intervals that the work of the navy becomes spectacular.

Nevertheless the Allied navies were a predominant factor in the World War, just as navies had been in nearly every conflict since the Greeks met the Persians at Artemisium and Salamis more than 2,000 years ago. They swept German commerce from the seas, and at the same time protected the transportation of supplies and soldiers for the Allies on every ocean. Throughout the war England and her associates held the seas, in spite of the havoc wrought by the German submarines; and in accordance with the terms of the armistice the German fleet was finally surrendered into custody in one of Britain's harbors, to await the decision of the Peace Conference as to its final disposal. What a spectacle was that of the silent triumph of a superior sea power, when, on Nov. 21, 1918, the battle-fleet of the Germans steamed slowly between the 40 miles of its British, French, and American conquerors, to surrender the power and pride of the German navy, built up by 20 years of costly effort!

Sea Power in the World War

Never before had ships of such great size and speed, or guns of such tremendous range and punishing power been opposed to each other on the high seas as in the World War. With airplanes and dirigible balloons

("blimps") for eyes, with the wireless and submarine detectors for ears, and destroyers and submarines as patrol guards, the great battleships of the contending powers opened fire upon each other at a range of ten miles in the battle of Jutland, and at even greater distances in other cases. Mine fields proved an important factor in the war; and German submarines were successful in several instances in destroying British and allied warships, but the undersea craft acted chiefly against merchant vessels which as a rule were unarmed or only lightly armed (*see* Submarine). The heavily armed battleships and battle cruisers, which can hurl projectiles weighing a ton for a distance of 20 miles, formed the backbone of the opposing navies; but it still remains a question how far the submarine has limited the effectiveness of the great dreadnoughts and super-dreadnoughts, each of which costs in the neighborhood of $30,000,000 to construct.

The innumerable ships which compose a navy belong to several great classes. The battleships are the biggest, most thickly armored, and most heavily armed style of ships that can be made and still be able to ride the seas. Eight years before the war Great Britain revolutionized naval construction by building the first *dreadnought*, a great vessel more terrible than all other battleships, armed with "all big guns." Immediately the other powers were forced to build ships like it, and all earlier built battleships were labeled pre-dreadnoughts. Then came super-dreadnoughts, war vessels which were stronger and more dangerous still, with 14- to 16-inch guns. Thus the Great Powers continued to vie with one another in producing bigger and bigger monsters of the sea, whose size was limited only by the size of harbors, docks, and marine canals. So rapid were the changes that no vessel could be called "first class" for more than five years, and the dizzily mounting naval budget threatened to bankrupt all the maritime powers of the world.

"OLD IRONSIDES"

This 44-gun frigate—"*Old Ironsides*," as Oliver Wendell Holmes affectionately called her,—is the most famous ship in American history. From the time she was launched (Sept. 20, 1797) her record was a brilliant one. As Commodore Preble's flagship, she took part in the bombardment of Tripoli in 1804. In the war of 1812, under Capt. Isaac Hull, she destroyed the British frigate *Guerrière* in a half hour's fight. Four months later (December 1812), Capt. Bainbridge added new honor to her name by capturing the *Java* off the coast of Brazil in a terrific combat. In 1814 the *Constitution* captured four prizes, and in 1815 triumphed in two hard battles over the *Cyane* and *Levant*. In 1830 the old vessel was condemned as unseaworthy, but was given new life by the poem of Holmes, containing these lines:

Ay, tear her tattered ensign down!
Long has it waved on high,
And many an eye has danced to see
That banner in the sky;
Beneath it rung the battle shout,
And burst the cannon's roar;—
The meteor of the ocean air
Shall sweep the clouds no more.

She was rebuilt and gave good service for another twenty-five years, making her last trip across the Atlantic in 1878. Since 1897 the *Constitution* has been used as a barrack ship in the Boston Navy Yard, where it may still be seen.

The second class of ships in the modern navies are the cruisers, of which there are many types, differing greatly in size, power, speed, armor, and armament. To the cruiser class belonged the German *Emden*, which did incalculable damage in many waters to the shipping of its country's foes until finally overcome by H. M. S. *Sidney* off the Cocos Islands in the Indian Ocean. The largest cruisers, called battle cruisers, are really battleships differing from the super-dreadnought only in having less armor and greater speed, enabling them to bring their tremendous guns to any part of a battle line in much quicker time than the heavier battleships.

Probably the busiest class of vessels in the late war were the "destroyers," which proved a veritable terror to enemy submarines and were extensively used in patrol and convoy service. They were designed some years ago to prey upon the torpedo boat—whence their name "torpedo boat destroyers," now shortened to "destroyers." Today torpedo boats as a separate class—excepting submarines, which are all torpedo boats—have practically disappeared; but torpedoes are still a part of the armament of battleships, destroyers, and heavy cruisers.

A torpedo of the usual "Whitehead" type (named from the inventor) is a cigar-shaped machine about 20 feet long, with propellers and compressed air engines to drive it along, a gyroscope steering gear,

HOW DESTROYERS SCREEN OTHER SHIPS WITH SMOKE

When navies want to hide ships from the enemy's gunfire or torpedo attacks, the firemen on the destroyers that are to make the screen change the draft. The big furnaces instantly begin belching out dense clouds of smoke. Within a minute after the signal, the vessels to be protected are hidden by a big black cloud, like those you see in the picture, and this cloud spreads out at a prodigious rate as the destroyers speed on their way. The enemy knows that somewhere back of the cloud is his prey—but where?

and a heavy charge of explosive in the head. Such a torpedo can be sent off from either above or below water, and it proceeds in a straight line at a fixed depth until it reaches the enemy ship, when it explodes by contact. The range of a modern torpedo is about five sea-miles and its speed 25 miles an hour. The torpedo is the most effective weapon of the submarine, but less dependence is placed in it now by battleships, owing to the long distance at which battles are fought.

Besides the ships used for fighting only, an immense number of auxiliary vessels are needed—mine layers, supply ships, fuel ships (colliers and oil-tank vessels), ammunition ships, hospital ships, transports, etc.—which are vital to the efficiency of the active fleet.

Great Britain long held the view that, owing to its island position and its empire scattered over the globe, considerations of safety made it absolutely necessary to have a navy as strong as the combined navies of any two other powers; and at the beginning of the World War she actually possessed more warships than her two nearest competitors, Germany and the United States. During the World War both the British and the United States navies were increased many fold by new constructions, while the best of the German navy was treacherously sunk by the Germans themselves at Scapa Flow after its surrender.

Battleships of the United States navy can usually be distinguished from those of other countries by the broad lattice mast, which is not used in other navies. American battleships and large armored cruisers are named after states, although sometimes the latter are named after the larger cities. Smaller cruisers are named after less important cities, and torpedo boats take the names of distinguished naval men. Submarines are the only class of vessel unnamed; as in other countries they are designated by numbers.

In the two years following its declaration of war in 1917, the United States spent more on the navy than in all the years since its creation in 1794. To this tremendous increase in American naval power, no less than to the great aid rendered by Great Britain, was due the accomplishment of the "biggest transportation job in history"—the carrying of 2,000,000 American soldiers with their equipment 3,000 miles across the Atlantic to the European battle line. The following table gives the naval equipment of the United States at the close of the war:

	Built		Building	
Class	No.	Tonnage	No.	Tonnage
Super-dreadnoughts	11	319,800	3	97,200
Dreadnoughts	6	115,650	..	.....
Pre-dreadnoughts	14	208,240	..	.....
Coast defense vessels	16	124,910	..	.....
Cruisers	31	221,550	..	.....
Destroyers	183	189,805	168	204,120
Torpedo boats	17	3,109	..	.....
Submarines	103	48,412	54	41,360
Mine planters	9	36,096	..	.....
Total	390	1,267,572	225	342,680

For any subject not found in its alphabetical place see information

"THE DAY OF A SAILOR" IN THE NAVY

When the first rosy tints of dawn play upon the great gray battleship, and the cheery notes of the bugle ring out, the busiest, most bustling life imaginable commences. Men roll out, lash their hammocks, and wash themselves and clothes. After breakfast, there is a brief band concert, the ship is made spotless for the day, and physical exercise, designed to build health and set the bodies glowing, follows. Then comes "general quarters," while the men go through battle drill, and the officers guide the ship through complicated turns and dashes as it fights an imaginary foe. Dinner breaks the day, and then come varied drills covering the many occasional duties a sailor may be called upon to perform. "Man Overboard!" is one of these drills. At sunset the colors are lowered, and the balance of the day is dedicated to relaxation and amusement. At "taps" the men snuggle down in their hammocks, except those who tend the throbbing machinery and keep lookout as the great steel mass plows through the night.

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A SEA FIGHTER AND ITS GIANT GUNS

This is one of the dreadnoughts in Uncle Sam's navy, and here we see six of her twelve enormous guns. You can judge of their size by the sailors astride them. Just now these great long-nosed engines of destruction are silent and peaceful, but if the vessel were going into action, those caps, called "tompions," that stop up the muzzles of the great barrels would be quickly removed, as would also the dark jackets that protect the base of the gun. In an incredibly short time the guns would be ready to hurl their enormous projectiles—all under the direction of the officers up in the fire control tower, which you can see high up on the mast.

The various commissioned officers of the United States navy are divided into the line and the staff. The titles in order of rank of the line officers are: admiral, vice-admiral, rear admiral, captain, commander, lieutenant-commander, lieutenant, lieutenant (junior grade), ensign, midshipman. The staff includes officers of the medical corps, pay corps, chaplains, naval instructors, etc. The warrant officers (non-commissioned) include boatswains, gunners, carpenters, pharmacists, and the like. The line officers are usually graduates of the Naval Academy (*see* Naval Academy, United States). Any citizen of the United States (under certain age limits) who can write and speak English and has no physical disability may be enlisted in the navy; the age limit varies with the rating. Apprentices are enlisted between the ages of 16 and 17, with the consent of their parents or guardians, and must engage to serve until 21. The regular enlistment period is four years. The president is commander-in-chief of the navy, as he is of the army, and its affairs are administered by the Navy Department, with the Secretary of the Navy at its head. (*See* United States, Government.)

SYMBOLISM OF THE UNIFORM

The uniform of the American sailor is one of symbolism. The thirteen buttons across the top of the trousers represent the thirteen original states. The bit of white showing at the neck is a tribute to Admiral Farragut. The sail in which his body was lowered to the water was divided among his sailors with the request that the pieces be worn across their chests. This established the custom of wearing the white "dicky," which is now replaced by a portion of undershirt. The use of the black tie and the three white stripes on the collar comes from the British navy. The tie was first worn after the death and in memory of Nelson. The stripes commemorate his three great victories.

The first great naval battle of which we have a clear story was the battle of Salamis, in 480 B.C., in which the Greek fleet defeated a horde of Persian vessels, and saved Athens and the western world from Asiatic invasion. These ships at Salamis were chiefly "triremes"—long "galleys" with three banks or rows of oars worked by slaves. In the days of Rome's power there were even "quinqueremes,"

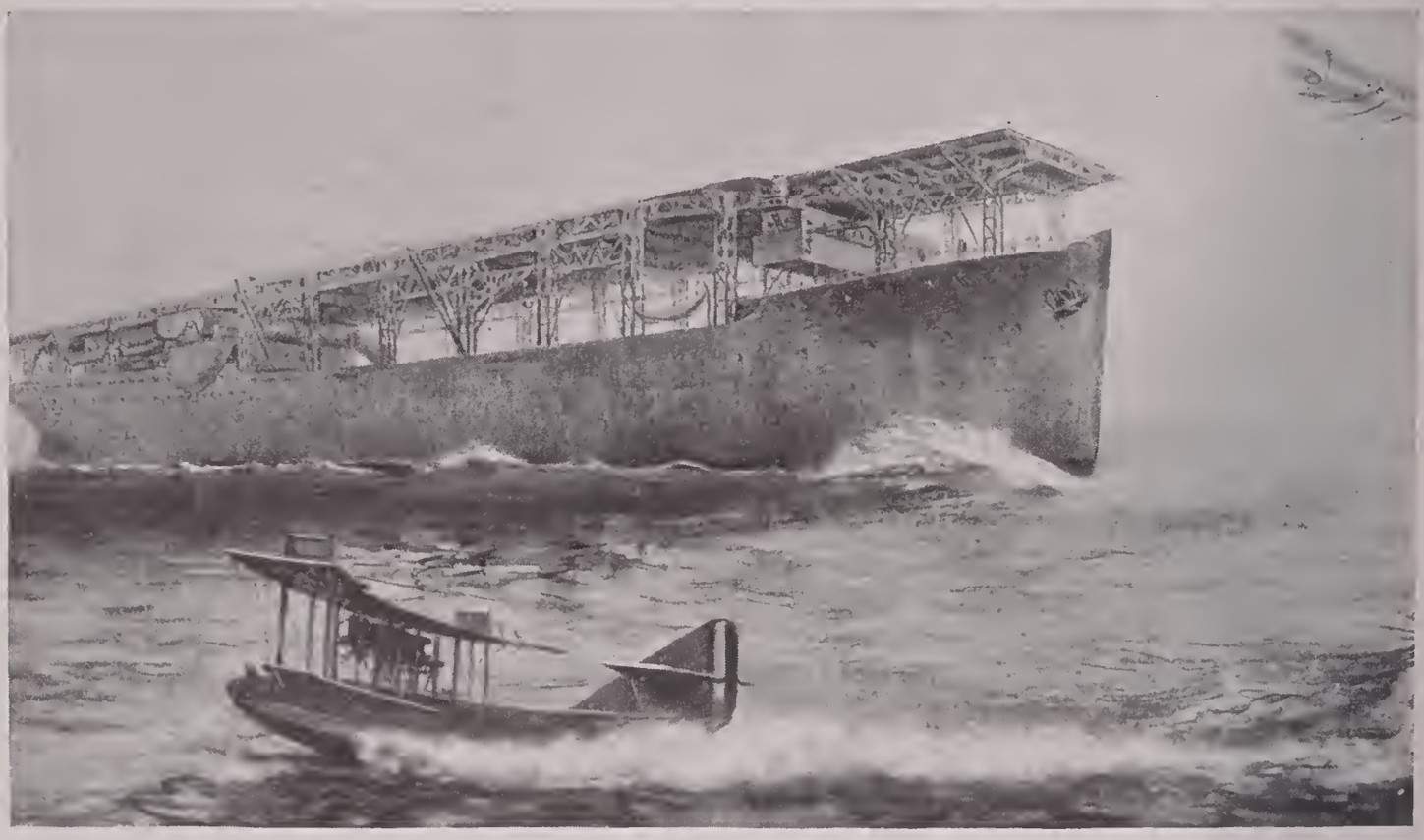
THE DEADLY STEEL "FISH" THAT SWIM TO THEIR MARK

These pictures illustrate the use of the torpedo, and the two kinds of vessels on which it is employed—the submarine, shown in the upper left-hand corner, and the destroyer, at the right. In the lower picture on the left the torpedo is being wheeled on its truck to the tube from which it is discharged into the sea. In the picture on the right we see it in the water.

—great high galleys with five banks of oars and rowers, placed one above the other. As late as 1571, when the West as represented by the navies of Venice, Spain, and the Papal States again defeated the East as championed by a vast Turkish fleet, at the battle of Lepanto, the vessels used were still galleys. But the galley of Lepanto was propelled by only a single row of oars on a side, each oar a long sweep pulled by four or five men.

The oared galleys, however, were adapted only to the comparatively calm navigation of the Mediterranean. During the Middle Ages the countries about the Baltic and the North Sea had adapted the sailing vessel to warfare, and the 16th century saw the transformation of all navies from oar to sail. Holland, which was then a great mercantile nation, long took the lead in naval power—as her victorious Admiral Van Tromp demonstrated in 1652, when he sailed the English Channel with a broom at his masthead, in sign of his intention to sweep the rival English navy from the sea. But the hardy sailors of Britain had already shown their power in 1588 by defeating the "invincible Armada" of Philip II (*see* Armada, Spanish), and in the next century they wrested the control of the sea from the Dutch. The 18th century was one long struggle with the French, but Nelson's great triumph at Trafalgar in 1805 (*see* Nelson, Admiral Horatio) definitely established Great

THE "MOTHER SHIP" AND HER "SEA BIRDS"



Some big fighting vessels have provisions for carrying and launching flying craft, but in order to have enough seaplanes with the fleets, navies need big "mother ships"—that's what they call them—that can carry a whole "flock." The picture shows the characteristics of such a "mother ship." From that long platform, as solidly supported as an elevated railway, these keen-sighted birds of the sea fly—there's one "taking off" now—and come back again. They can also light on the water, and, coming alongside of the "mother ship," be lifted up by cranes and lowered down among their companion "birds" in the hold of the vessel.

Britain's naval supremacy and her position as a maritime empire. Misuse of that power during the Napoleonic conflict brought on the War of 1812 with the United States; and although America had fewer ships, it proved the equal of the British in seamanship and even superior in ship-building and gunnery. The honors of that war belong chiefly to the United States frigate *Constitution* ("Old Ironsides"), which won four memorable successes against the British.

Steam and the "Ironclads"

The next great changes in naval warfare took place with the introducton of steam power and ironclads, in place of the old wooden sailing ships of war. It is hard to realize that all our modern ironclads are developed from the little "cheese box on a raft"—the *Monitor* of Civil War fame—and that when it beat the *Merrimac* all other ships were beaten too, and all maritime governments were forced to build fighting vessels with steel armor. Then began a race among the nations to improve their powder and strengthen their guns, and to defend themselves by building bigger and bigger warships with heavy armor. Fighting vessels became finally forts of steel afloat, and still guns were able to pierce their hulls. New processes of hardening ship armor were followed by new improvements in guns and projectiles, rendering them capable of piercing even ten-inch nickeled steel. Fuel oil, which can be stored in small space and is almost smokeless, is now used on all of the newer battleships; and the United States has developed a system called the "electric drive," whereby the engines run dynamos, and the current is used in motors attached to the propellers.

As a result of all this development, the present-day battleship of the latest type is of 42,000 tons displacement, or more, mounts a main battery of twelve 16-inch guns, and a secondary battery of 20 or more guns of medium caliber. It has anti-aircraft guns, is elaborately subdivided into watertight compartments so that one or two torpedoes cannot sink it, and is heavily armored both against projectiles aimed at the sides and plunging down through the decks. Its speed is upwards of 25 miles an hour, and it carries a crew of more than 1,600 men.

The Airplane and the Submarine

The most important change of all lies in the fact that while earlier navies, since the beginning, have had to operate only on the surface of the sea, the World War has taught that a modern navy must also navigate the depths below the surface and the air above. (*See* Airplane; Submarine). The airplane has proved its usefulness in long range scouting, and is developing its ability to attack with bombs, while the submarine is a powerful means of defense in confined seas or off-shore waters. It has also compelled the provision of convoy for all unarmed ships. So far, however, neither has shown powers that doom the battleship, and dreadnoughts are still the reliance of navies.

The FERTILE PRAIRIES *of the* "CORNHUSKER STATE"

Extent.—North to south, about 208 miles; east to west, about 465 miles. Area, 77,520 square miles. Population (1920 census), 1,296,372.

Physical Features.—Gently rolling prairies in east, rising toward the west (lowest elevation, 840 feet); grassy sandhills in center; elevated plains (about 4,000 feet) and foothills of Rocky Mountains (highest point, about 5,300 feet) in west; "bad lands" in northwest corner. Principal rivers: Missouri and its tributaries, the Niobrara, Platte, and Republican.

Principal Products.—Corn, wheat, oats, hay, sorghum, and kafir corn, potatoes, sugar beets; cattle and hogs; packed meats, butter, cheese, flour and other wheat products, sugar, potash.

Chief Cities.—Omaha (195,000), Lincoln (capital, 55,000), Grand Island, Hastings, North Platte, Beatrice, and Fremont.

NEBRASKA, Well-tilled acres of corn and wheat and green pastures covering the gently sloping plains, tidy farmhouses and groups of planted trees, giving evidence of plenty and comfort attained through well-directed industry and thrift—this is a typical scene in Nebraska, one of the nation's great larders, producing vast supplies of bread-stuffs and beef.

Some parts of Nebraska, it is true, present quite a different aspect, for in its 77,520 square miles (larger than all New England) there is room for many varieties of scenery. On the banks of the Missouri River at the eastern border steep bluffs show their varied outlines against the clear blue of the sky. The Niobrara River in the north flows for part of its course through rugged and picturesque canyons, clothed with pines and cedars and abounding in innumerable springs. Near the western border are hills that rise almost to the dignity of mountains. In the extreme northwest corner extends a small section of the "bad lands" of South Dakota—fantastic hills and terraces rich in fossil remains of prehistoric ages. East of the foothills and bad lands are table-lands, and east of these, stretching irregularly across the center of the state, is a vast sweep of sandhills, mostly treeless and with scarcely a rock or a pebble to break the smooth outlines of their grass-covered slopes. Although these once shifting dunes have become stable with the cessation of prairie fires and the advance of settlement, "blowouts" scooped in their sides by the wind are still characteristic landmarks. Toward the east these hills become rolling prairies, including three-fourths of the area of the state.

NEBRASKA'S PRODUCTS

Of the total value of Nebraska's products, more than three-fourths comes from its farms and grazing lands.

Early explorers called the Nebraska region the "Great Desert," for in the extreme western part the rainfall is too scanty to support crops, and, before it was broken by the plow, the densely matted sod of the eastward-sloping prairie drained most of the water off into the rivers. But since Nebraska farmers have learned to tap the inexhaustible treasures of underground water which underlies nearly all the state, there is practically no part which cannot be successfully cultivated. Plowing and irrigation are said to have raised the level of the underground water-table in many places. In the eastern part of the state, since

ONCE PART OF A "DESERT"—NOW RICH FARM AND PASTURE LAND

Before they knew how to farm such land, early residents thought that large parts of Nebraska were a barren waste. Now, however, practically every part of it produces abundantly. Farming is concentrated in the eastern part, while the vast sandy ranges of the upper northwest portion are unexcelled as grazing land for cattle. At the left we see the relative proportion of the religious denominations of the state.

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nearly half the annual rainfall comes in the three growing months, May, June, and July, it is sufficient for crop needs. In the western third, especially in the Platte and Republican valleys, irrigation is extensively practiced. In the valley of the North Platte, canals constructed by the United States distribute water from the immense Pathfinder reservoir, which holds about 1,000,000 acre-feet of water drawn from melting Colorado and Wyoming snows. Dry farming methods have produced phenomenal yields in the same region on land which cannot be irrigated.

Its many varieties of rich soil and especially the deep, mellow, moisture-retaining subsoil, now that farmers have learned how to treat them, make Nebraska one of the greatest agricultural states of the Union. It is among the five leading states in the production of corn, and stands high for oats, wheat, prairie hay, and alfalfa. There are more than a hundred native grasses, some of great value, which help to feed great herds of cattle. The live stock industry is of great importance, the sandhill region producing a high quality of range beef, while on the farms to the east great numbers of cattle and hogs, home-grown or imported from other states, are fattened for the market on Nebraska corn. Sugar beets, raised under contracts with the factories, are an important crop in the river valleys. Potatoes constitute another important crop, much of which comes from the irrigated lands. Much of the American boy's popcorn comes from central and northeastern Nebraska. The orchard industry is of increasing importance in the southeastern part of the state. Apples are most generally raised; peaches, cherries, nectarines, and small fruits are also grown.

Though Nebraska is primarily an agricultural state, manufacturing industries are steadily growing, particularly those based on agriculture. It ranks high in the production of creamery butter, and the meat-packing plants of South Omaha are the third largest in the United States. It has several beet sugar factories, and hundreds of flour mills. Nebraska will never be a great manufacturing state, however, because it has no coal. It has been called "the state without a mine" and mineral products in general are of little importance, but in recent years much potash and other salt products have been manufactured from the waters of the alkali lakes in the sandhill section. When imports from Germany were cut off during the World War of 1914–18, this was one of the chief sources of the American supply. The beet-sugar wastes were also treated to recover their potash content. One sugar factory produced nearly 1,500 tons of potash the first year. Building stone and clay products, pumice, and gravel are important industrial items. Volcanic ash, particularly from the Republican valley, is used by packing-house companies in making scouring soap and cleansing powders.

The climate of Nebraska is exceptionally healthful. Though extremes of temperature are reached, both heat and cold are less severely felt because of the dry atmosphere. The "scenery of the sky," especially the splendor of a Nebraska sunset seen across the rolling prairie, compensates for the lack of grandeur which mountains, lakes, and forests lend other states.

Generally known as the "Cornhusker State," Nebraska is officially called the "Tree Planters' State." The first settlers found a prairie almost entirely without trees except along the streams and

WHAT LIFE IS LIKE ON A BIG NEBRASKA STOCK FARM

You see this Nebraska farmer is one of those wise men who believes in sending his corn to market on four feet by fattening his cattle with it. Don't you think it would be fine to live out on those wide prairies in a house like that, and to raise such cattle? And, of course, those four-footed Nebraskans find it mighty pleasant too, with the nice prairie hay, and the corn, and the alfalfa, and the fine water supply pumped up by windmills.

SOME OF NEBRASKA'S CHIEF ATTRACTIONS

Like most of the prairie states, Nebraska's chief wealth is in her farm and stock products. Some industries, however, such as meat packing and potash production, are important, and her public institutions are noteworthy. The new Capitol building, for instance, is unique in a land where almost every other state has followed the architectural style set by the National Capitol at Washington. The university is well known throughout the country.

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on rough uplands, and to their forethought are due the pleasant groves and tree-lined roads found everywhere today. Arbor Day, now observed as a holiday all over the United States, was first instituted in the state of Nebraska.

The population of Nebraska is largely native American, only about 15 per cent being of foreign birth. For a number of years Nebraska and her neighbor Iowa have been close rivals for the lowest percentage of illiteracy in the United States. This is due to the high development of the state school system, which includes the excellent University of Nebraska, situated at Lincoln, the capital.

The state's packing industries are centered chiefly at Omaha, the largest manufacturing center (*see* Omaha). Lincoln is chiefly an educational center, but has a number of important and growing manufactures, notably of leather goods, motor trucks, gas engines, and airplanes. Grand Island rivals Omaha as a world market for horses and mules. It is the seat of the State Soldiers' and Sailors' Home and is the distributing center for a large part of northwest Nebraska. Hastings is an agricultural and manufacturing center, dealing in flour, farming implements, wheat, corn, and live stock. North Platte exports cattle, sugar beets, and alfalfa. The manufactures of Beatrice include flour mills and creameries. Fremont is an important horse and cattle market.

The name Nebraska, which means "flat or shallow water," was first given by the Indian tribes to the river, now called the Platte, which traverses the state. Coronado probably reached Nebraska in his explorations in 1540–42. There are records of French fur-trading posts in this district as early as 1794, and in 1807 the brothers Chouteau were on the Platte.

In the Days when Nebraska was Nameless

In 1803 Nebraska passed to the United States as part of the Louisiana Purchase (*see* Louisiana Purchase), and between 1810 and 1826 the American Fur Company established posts at Bellevue, Omaha, and Nebraska City. From 1812 to 1821 Nebraska was a part of Missouri Territory; then for a time it was merely a part of the public domain and "Indian country." "Squatters" pushed in, and in 1854 Nebraska and Kansas were both organized as territories by Senator Douglas' bill, with decision as to the permission of slavery left to the settlers (*see* Kansas-Nebraska Act). With the organization of Dakota, Colorado, and Idaho territories, Nebraska was reduced to practically its present limits. Steps were taken for the admission of Nebraska as a state in 1864, but not until 1867 was admittance granted, and then over President Johnson's veto.

The completion of the Union Pacific Railroad to the western line that same year brought floods of immigrants, largely former Union soldiers. The grasshopper plague of 1874–75 caused the constitution of 1875 (known as the "Grasshopper Constitution") to be framed with a view to economy. A war with the Sioux Indians during 1874–77 ended in the removal of the Indians from the state. The next great immigration period (1880–90) was marked by conflicts between cattle men and homesteaders. Droughts in 1890 and 1894 caused destitution and abandonment of homesteads, and initiated the new agricultural era —marked by irrigation, dry farming, and cultivation of sugar beets, winter wheat, and alfalfa as staples. In 1900 the farmers' coöperative elevator movement began, at first as a struggle with the grain dealers and railroads, but later growing in scope as it increased in membership.

NEBULAE. A few of the stars when carefully observed seem to have a faint hazy appearance or to be surrounded by a kind of bright mist. The telescope shows us that some of these are star clusters, consisting of as many as 50,000 separate suns, while others are true nebulae. Instead of being separate suns the nebulae are vast aggregations of gaseous or semi-gaseous matter which assumes various cloudlike forms. The name *nebula*, in fact, is the Latin word for "mist" or "small cloud."

Nebulae are frequently divided into two classes—the green and the white. The large irregular nebulae are usually green, and are found in or near the Milky Way. It is supposed they are mainly gaseous. Spiral nebulae, on the other hand, are white and may contain solid as well as gaseous matter. They are by far the most numerous of the nebulae, and are quite widely distributed. As with the case of the stars, the composition of the nebulae is discovered by means of the spectroscope. They contain at least one unknown element, a gas which is called nebulium.

Like clouds, the nebulae have an infinite variety of shapes, and through the telescope they often present a picture of unsurpassed splendor. The great chasm in the Orion nebula is sometimes regarded as the most beautiful object anywhere in the heavens. One observer sees "pillars, columns, walls, facades, bulwarks, stalactites, and stalagmites within deeps of deeps; it is like looking in at a door and to the rear of a cave, deep with glittering nebulosity." Some nebulae are ring-shaped, some spiral, and some planetary (disk-like), while others are given such fanciful names as "crab," "dumb-bell," "keyhole," and "swan."

Only two nebulae are usually visible to the naked eye—the great irregular nebula in Orion's swordhilt, and the spiral nebula in Andromeda's girdle. But thousands of others can be seen through the telescope. The ring nebula in Lyra, the spiral nebula in Ursa Major, the irregular nebula in Cygnus, and the nebulae among the Pleiades are interesting.

The size of some of the nebulae is exceedingly great. If they were as near as the sun they would fill the heavens with an enormous blaze of light. The diameter of the Orion nebula, the greatest in the sky, is probably 20 million times that of the sun. Their velocity is likewise staggering. We know, for example, that the Andromeda nebula is approaching the solar system at the rate of 200 miles a second.

In modern times the nebulae have probably been the subject of more speculation than any other group of heavenly objects. Practically all theories of the origin of the solar system assume that it evolved in some way out of nebulous matter. The most recent theories regard the spiral nebulae, in particular, as representing a possible early stage of the evolution which ultimately produced the sun and the planets. How the spiral nebulae themselves were formed can be no more than a guess. They may have resulted from the close approach of two suns, or perhaps from the collision of great groups of suns.

THE GREAT NEBULA IN ANDROMEDA

This great mass of glowing gas, millions of miles across, is just visible to the naked eye as a fuzzy star in the girdle of Andromeda. The picture shows how it looks through a high-power telescope.

According to the French astronomer Laplace (1749–1827), all the matter constituting the solar system was once a great mass of glowing hot vapor or gas, resembling one of the gigantic nebulae we can now see through the telescope. This mass was supposed to be rotating at an enormous rate of speed. As it cooled and contracted, the central mass began to rotate still more rapidly till a series of rings (like those around Saturn) were thrown off and left behind. These rings, according to the theory, then condensed into planets, one of which is the earth. As the process went on the planets themselves threw off rings, which in turn condensed into moons or satellites. Saturn's rings are referred to as an example where the process is not complete. The rotation of the original mass produced the revolution of planets and satellites in their orbits.

Laplace himself cautioned people that his theory was advanced "with that distrust which everything ought to inspire that is not a result of observation or calculation." The nebular hypothesis has now been generally abandoned as the explanation of the formation of the solar system, simply because it fails to harmonize with modern observations and calculations, and what is called the "planetesimal theory" seems more probable (for an explanation of this theory, *see* Planets).

Needle. Take a common steel needle and examine it carefully. Notice how highly it is polished and how evenly it tapers to its sharp point. Now hold it to the light. See how wonderfully thin the metal is on either side of the eye, so that the eye part is no larger than the shaft. Notice how smoothly the edges of the eye are rounded and the inside ground, so that the thread will not catch and fray.

Sometimes we see a needle of a century ago, which has been kept as a curiosity. It is badly formed, one side flatter than the other, the head considerably larger than the body, and it is scratched as if it had been polished with emery paper. Yet such needles are very much superior to those used by uncivilized races today, or to any left us by the ancients. Needles of fishbone, stone, iron, and bronze have been found that were used by early peoples more than 10,000 years ago. Some of these old needles have the eye for carrying the thread at the point, as in the modern shoemaker's awl; some have it halfway between the head and the point; and some have no eye at all, but were merely used like an awl to punch holes, through which the plant fibers or thongs of leather could be drawn.

Not less than 20 different processes go into the making of a steel needle today. Steel wire, drawn especially for the purpose, is cut into pieces the length of two needles. As the wire has been wound on spools, these little pieces of wire are slightly curved. To straighten them they are gathered into bundles and heated until they glow dull red; as they cool they are rolled to and fro over an iron plate and pressed with a curved bar. Next the wires are carried along to a grindstone and held against its face with a rubber band till a sharp point is put on each end. A rapidly revolving pulley draws these wires from the wheel and feeds them into a machine, which marks the place for the eyes. The eyes are punched by other machines, and the double needles are strung on two slender wires; thus when divided between

the eyes, each row is still strung on a wire. The heads are next filed into shape in a viselike arrangement, and the needles are ground, polished, and tempered until they are the perfect product with which we are familiar. Sorted according to size, they are put up in papers or boxes. Practically every step in the work is done by a machine, thus making it possible to sell them for less than a cent apiece.

Besides the common sewing needle we have a great variety of others—sewing-machine needles, needles designed for sewing canvas, leather, upholstery, etc. Knitting needles and crochet needles are not really "needles," for they have no eyes.

NEGRO. The negro race in the broad sense includes the wooly-haired, thick-lipped, broad-nosed, black or dark brown inhabitants or former inhabitants of Africa. From middle Africa, where the pure negro is found, the type shades off by gradual and imperceptible steps into the Semitic (Arab) and Hamitic (Egyptian and Libyan) types in the north, and into the Bushmen and Hottentots in the south. (*See* Africa.) Outside of Africa, types resembling the negro, called "negroids" and "negritos," exist on some of the larger islands and coasts of the western Pacific Ocean, notably in certain parts of the Philippines, on the Malay peninsula, and in Australasia.

Through importation as slaves, the true negro types are found in almost all parts of the two American continents, largely mixed with white and native Indian blood. The mixture of negroes and Indians occurs chiefly in Central and South America. In Brazil, where the slave trade with Africa continued until 1854, the negro elements form today a large proportion of the population (*see* Brazil). In Cuba, Haiti, Jamaica, and throughout the islands of the West Indies the black race predominates.

In the United States, an exceptional situation exists, for the races have not blended together to the extent elsewhere. A sharp line of distinction is drawn between whites and blacks; and all who have negro blood, even in a small proportion, are classed generally as negroes.

The First Negroes in America

The negro question in the United States dates back to 1619, when 20 slaves were landed and sold in the Virginia colony. The importation of negroes, chiefly from the Guinea coast of Africa, continued until 1808, when it was forbidden under a provision of the Constitution. At that time there were about 1,400,000 blacks in the United States. At the close of the Civil War, this number had increased to about 4,500,000. Today there are roundly 11,000,000, excluding those in Porto Rico and other dependencies. The majority of these are in the Southern states, where they form more than one-third of the population. It has been estimated that something like one-fourth of all the negroes in the United States have at least a trace of white blood in their veins.

From the moment the negro slaves were freed by the Civil War, a host of social, political, and economic questions arose. The sudden political power which was thrust into their inexperienced hands confused them and created great disorders, especially in the South. Scheming politicians often won their support and used their votes for evil purposes. This at once created a feeling of enmity toward them in many sections of the country. This feeling, intensified by occasional race disorders, continues where ignorant whites and blacks mingle in large numbers.

The results of these race differences are felt by the negroes principally in the southeastern states, where they are at once most numerous and least educated. Although the Constitution was amended so as to give all negroes the right to vote, many states have passed laws which deprive the majority of them of this right. In many commonwealths there are also "Jim Crow" laws which require separate schools and separate street-car and train accommodations for negroes, which forbid the intermarriage of whites and blacks, and in general make the racial division as sharp as possible.

The "Color Line" in Labor

As an industrial worker the negro also finds the color-line drawn against him. With the growth of labor unions, the door to many of his former employments is slowly closing. Although the unions do not usually bar him in theory, every obstacle is put in the way of his membership and he is compelled to fall back upon unskilled work at lower wages.

Despite these handicaps, the negroes of the United States are making steady progress in wealth and education. The percentage of illiteracy has decreased from 80 per cent in 1870 to about 30 per cent. They are taking, in large numbers, to the occupation of their forefathers in Africa—farming. They make up today 47 per cent of the people engaged in agriculture in the Southern states, and 25 per cent of the negro farmers own their land. As an indication of the progress in this direction, it is interesting to note that 39 new agricultural schools for negroes were opened in a single year recently. In various lines of commercial business, especially retail trade, the negro is becoming increasingly successful.

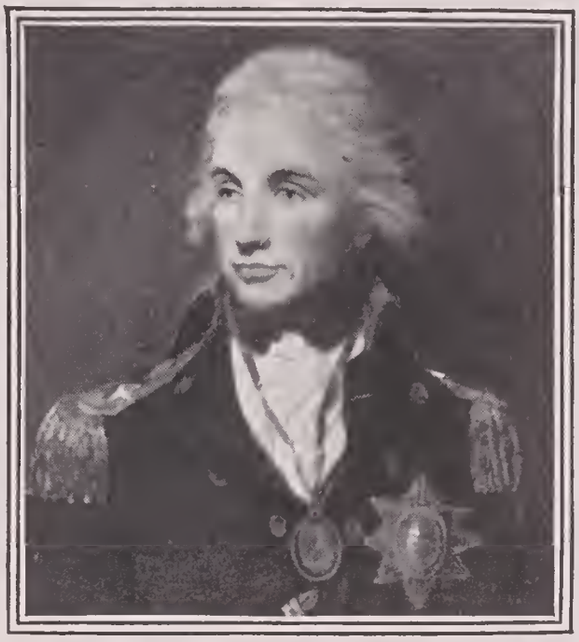
The patriotism of the colored population of the United States and their worth as soldiers was amply demonstrated in the American Expeditionary Forces in France during the World War. Elaborate propaganda inspired by Germany to incite the negroes of the United States to rebellion proved futile. Unfortunately the increase of good feeling between the whites and blacks thus produced was counteracted by the influx of negroes to Northern cities in 1917 and 1918. At the conclusion of the war this increase in negro population and the resulting economic rivalry with whites led to racial outbursts in several places.

Until after the Civil War no serious effort was made to educate the negro. In fact, the slave was often forbidden by law to learn to read and write. As soon as he gained his freedom, church societies in the North began the great task, and large numbers of

men and women teachers went into the South and started schools. The Freedmen's Bureau provided government aid from 1865 to 1870. The Hampton Normal and Agricultural Institute in Virginia, which was opened in 1868, is perhaps the best example of this private educational work. From this school was graduated Booker T. Washington, the greatest educator of the negro race, who later founded the famous Tuskegee Normal and Industrial Institute in Alabama (*see* Washington, Booker T.). The number of these educational institutions supported by private endowment has gradually increased both in the North and South, but the progress in public schools has not been so rapid. Some of the Southern states spend less than three dollars a year on each of their negro pupils, while the corresponding outlay for white children is more than $10.

Through the efforts of educated negroes, however, much is being done to remedy this condition. The Southern Educational Board has been formed to promote the training of negroes for the practical duties of the citizen. Each year sees more teachers, physicians, dentists, lawyers, and progressive business men among the ranks of the black race.

HORATIO NELSON



"The most famous naval commander of the greatest maritime power in history."

NELSON, ADMIRAL HORATIO (1758–1805). The most famous naval commander of the greatest maritime power in history was, like James Watt, so frail that he was not expected to live to maturity. His father's small income as rector of the little parish of Burnham-Thorpe in Norfolk forced the boy to leave the home nest at 12 and enter the navy as a midshipman. His uncle, on whose vessel he made his first voyage, thought that the idea of trying to make a sailor out of the delicate undersized boy was a piece of folly, and that the most merciful course would be to discourage him. So the first day at sea he ordered the boy aloft, saying, "You are afraid, lad?" "Yes, sir," replied the shivering morsel of a man, "I'm afraid, but I'm going to the top of the mast, sir." And go he did. But he never forgot that sickening experience, and when at the early age of 21 he was captain of a frigate, he used to race the new boys up the mast and salute them at the top. The little fellows, frightened half to death but full of British grit, never disappointed him. He abolished some of the severe punishments then practiced, saying that cruelty made cowards. He promoted brave men and treated members of the crew with great consideration. As a result his ships soon were famous.

Nelson's rise to fame began in 1793, during the war with Revolutionary France, when he was put in command of the 64-gun ship *Agamemnon*. Repeatedly during the next three years he distinguished himself by bravery, coolness, and judgment. During one of the famous engagements of this period—the battle of Calvi—he lost his right eye; and not long after, in a disastrous assault on Santa Cruz, in the Canary Islands, he received a wound which cost him his right arm.

His heroism was rewarded by a pension, knighthood of the Order of the Bath, and promotion to the rank of rear-admiral. Now came Nelson's great chance. He was assigned to hunt out and destroy the fleet by which Napoleon hoped to invade Egypt and strike England in her most vulnerable spot—India. On Aug. 1, 1798, he attacked the French ships in the Aboukir Bay at one of the mouths of the Nile. "Where there is room for a French ship to swing at anchor," he said, "there is room for an English ship to sail"; so he boldly sent half his fleet into the narrow space between the French ships and the shore, while the rest attacked from the seaward side, thus raking the enemy from both sides. This smashing victory of the Battle of the Nile, as it was called, made the one-eyed and one-armed admiral the idol of England. He was raised to the peerage as Baron Nelson of the Nile, and wealth and honors were heaped upon him.

Three years later (1801), when he had become vice-admiral, Nelson was sent to coerce the Baltic states, winning a notable victory over the Danish fleet at Copenhagen. In the midst of the battle Nelson's superior hoisted the signal of recall. Putting the telescope to his blind eye, Nelson said: "I really do not see the signal," and turned what might have been disaster into triumph. For this exploit he was made a viscount.

The Great Battle of Trafalgar

After a few months of leisure, Nelson was called from retirement to defend England once more from the menace of Napoleonic invasion, and put in sole command of the Mediterranean fleet. For 14 months he lay off the port of Toulon. When the French fleet slipped out, he chased it to the West Indies and back; laid siege to it and the allied Spanish fleet in the harbor of Cadiz; and brought them both to bay off Cape Trafalgar (Oct. 21, 1805). In going into battle Nelson flew from the mast head of the *Victory* the signal that ever since has been Britain's watchword: "England expects that every man will do his duty."

The fleets of the enemy were destroyed by Nelson's skilled attack, but in the hour of triumph the great commander fell mortally wounded. As he lay dying, wild cheers rang out as ship after ship of the enemy struck its colors or sank beneath the waves.

"England is safe," he murmured, looking up into the face of the officer who bent above him. His simple loving heart turned like a boy's to his old comrade in arms for the last office of affection, as he murmured: "Kiss me, Hardy." His last words, before his soul drifted to the Great Unknown, were: "I have done my duty, thank God!"

His flagship brought the news of the victory home, but its flags were at half-mast. England's "greatest seaman since our world began," as Tennyson called him, was laid away in St. Paul's Cathedral, London.

Nemesis (*nĕm'ē-sĭs*). The personification of divine justice, Nemesis, was represented in earlier Greek mythology as a goddess, the daughter of Night. The name meant originally the one who measures out; hence she was regarded as the one who distributes good or bad fortune to each man according to his deserts, and punishes any violation of justice or any arrogance or presumption on the part of men. Later she was thought of only as the angry avenger of crime, pursuing the evil-doer relentlessly like the Furies or Erinyes (*see* Furies). She was sometimes represented as carrying a measuring rod, a bridle, a sword, and a whip—emblems of her functions.

Neptune. In Roman mythology the name Neptune is given to the Greek sea-god Poseidon. He is usually shown as a bearded man standing in a shell drawn over the sea and holding a three-pronged spear or trident (*see* Poseidon).

In astronomy the name Neptune is given to the outermost planet of the solar system. It is 30 times as far from the sun as the earth, and is invisible except through the largest telescope. Its discovery in 1846 came as the result of certain investigations in the movements of Uranus, which led two astronomers to predict the presence of an unknown planet at the exact place where the telescope revealed Neptune. This large planet is over four times the diameter of the earth and takes 164 earth years to go around the sun. (*See* Astronomy; Planets.)

Nero, Emperor of Rome (37–68 A.D.). Lucius Domitius Ahenobarbus Nero, who has become a synonym for a monster of iniquity and cruelty, began his reign in the year 54 A.D. at the age of 17, a handsome, talented, and by no means bad-hearted youth. Although Nero owed his throne to a crime, the blame for this rested on his wicked mother Agrippina, whose ambition for her son knew no bounds. She married the emperor Claudius, and influenced him to put aside his own son, Britannicus, in favor of Nero. Then, impatient to see her son on the throne, she caused Claudius to be poisoned.

The Romans looked with favor upon Nero, since he was descended on both sides from the great Augustus. Under the influence of his tutor, Seneca—a wise philosopher and brilliant writer (3 B.C.–65 A.D.)—all went well for a year. Then Nero's evil traits began to develop. Worst of all, he was cowardly, and committed one crime to cover up another. He caused Britannicus to be poisoned in 55 A.D., and four years later had his own mother slain by swordsmen. He divorced and later put to death his wife Octavia. He killed his second wife Poppaea Sabina in a fit of rage. A third woman who refused to marry him was slain, and he killed the husband of a fourth woman so she might become his wife. He was insanely suspicious of all his associates. Upon discovering a plot against him, he had Seneca put to death, together with many other famous men.

Did Nero Fiddle while Rome Burned?

During his reign a great fire broke out in Rome which burned for a week and destroyed more than half the city. It was rumored that Nero himself had started the fire and that, as he watched the conflagration, he played upon his fiddle and recited verses about the burning of Troy. Historians agree that there was probably no foundation for this charge, but at that time many believed it. In order to free himself from suspicion, Nero fastened the blame upon the Christians, and caused numbers of them to be put to death with the most cruel tortures. This is considered the first of the ten great persecutions of the Christians under the Roman Empire.

After the fire, Nero set about rebuilding the city, and erected for himself a magnificent palace called the "Golden House." But his heavy taxation, misgovernment, and cruelty caused discontent and then revolt in the provinces. The rebellious troops under Galba, the Roman governor of Spain, marched upon Rome and were joined by the emperor's own bodyguard. Nero fled, and news came to him in his hiding place that the Senate had sentenced him to death and proclaimed Galba emperor. At the approach of horsemen who came to drag him to execution, Nero commanded an attendant to stab him to death, exclaiming, "What an artist dies in me!"

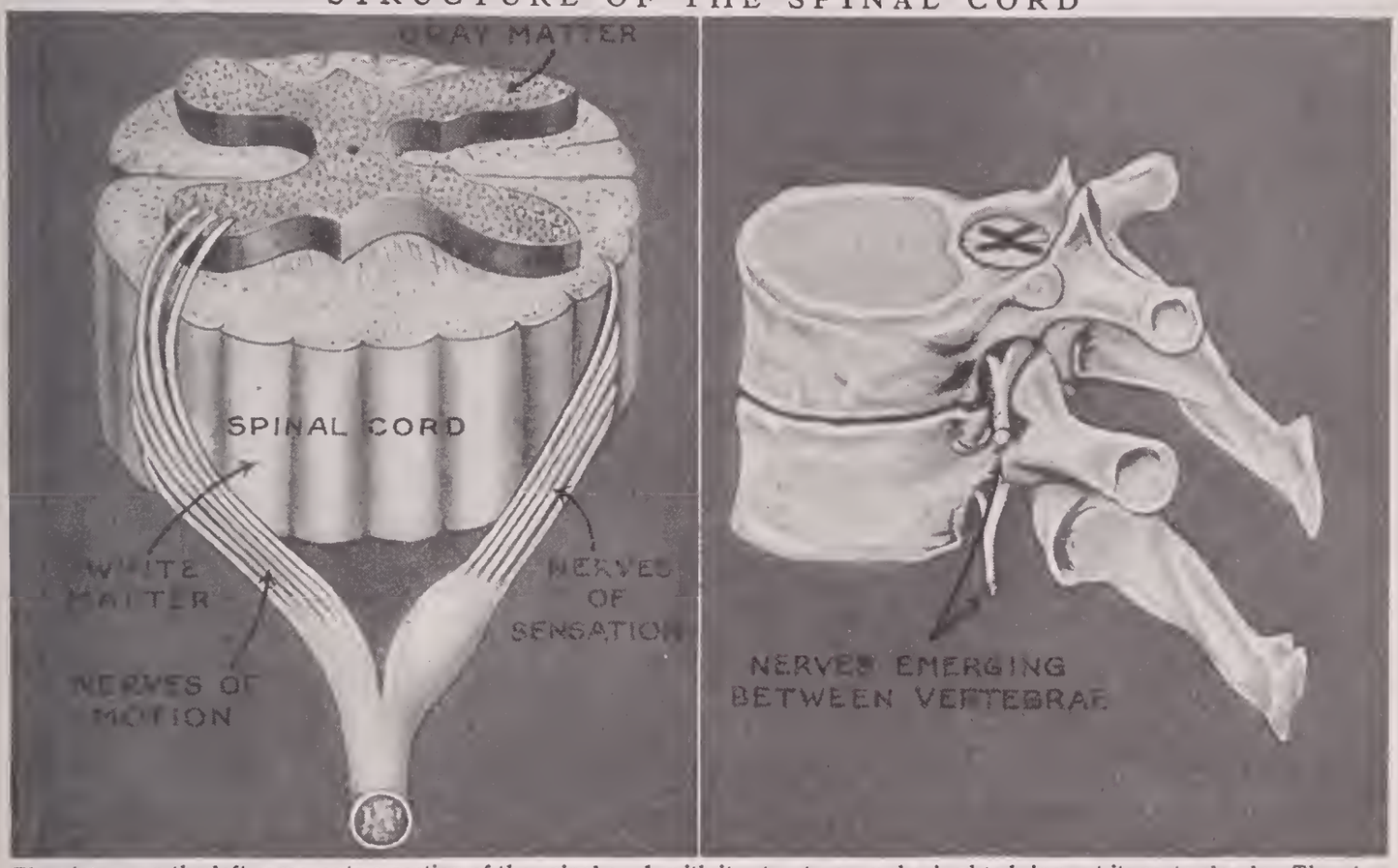
Thus passed away the last of the Augustan line of Caesars. His enthusiasm for art and any other good qualities he may have had were soon forgotten, and his name is one of the blackest in history. (*See* Roman History.)

Nerves. "Ting-a-ling!" You go to the 'phone and hear your friend speaking on the other side of town. There is a wire from his house to central and one from central to your house. The operator connects the two and then you can talk with each other.

The nerves form the "telephone system" of the human body. They put every individual part of it into direct communication with the "executive offices" in the brain and thus with one another. Anything which interferes with this communication leaves the organ so cut off that its food may be endangered, its wastes may accumulate, and it may become a prey to disease. In any case it is out of control and its usefulness destroyed or impaired.

Unlike the city telephone system, each of the nerve wires or fibers carries messages only in one direction. Oftentimes there is a special "private cable" which takes care of a particular kind of business and that only. For example, the optic nerve takes care of "sight" messages only; the auditory nerve of "sound"; the olfactory of "smell," and so on.

STRUCTURE OF THE SPINAL CORD



The picture on the left represents a section of the spinal cord, with its structure emphasized to bring out its parts clearly. The view is from the left and shows sensory nerve fibers entering the cord at the back, and the motor fibers emerging from the front. The right-hand picture shows two vertebrae, with the location of the spinal cord marked by the cross-like appearance of its gray matter.

Those nerves which carry in-coming messages, i.e., toward the brain, are called "afferent" nerves and it is they that bring us all of our information from the outside world. Those which carry out-going messages are known as "efferent" nerves, for they are concerned with the various activities of the body. Some efferent nerves are "motor," that is, they cause muscles to contract; others are "secretory," that is, they cause glands to secrete. The nerves can be seen as the whitish cords that run between the muscles of the body, branches going into each muscle and to every part of the skin. Usually we find the nerve fibers for any part of the body bound together into one bundle or cable, and they do not separate until just before they reach the spinal cord. There they divide into two roots, and each root contains only one kind of fibers. One root enters the spinal cord toward the front. This root contains efferent fibers. The other root enters the spinal cord at the back and is composed of afferent fibers.

These afferent and efferent fibers connect with collections of nerve cells in the cord. And we learned when we studied the brain that such collections were composed of "gray matter," and they both receive and originate messages. They are the "branch exchanges" of our telephone system. They are connected with the chief exchange in the brain. Those efferent nerves which deal wholly with our involuntary or unconscious life (such as heart action, secretion, stomach and intestinal movements, and the like) are called the "sympathetic" nerves; while those nerves which deal with our conscious movements, directing our voluntary acts, are known as the "cerebro-spinal" nerves. The "cerebro-spinal" nerves are attached to the spinal cord. The sympathetic system has its own connecting fibers running outside the vertebrae, and has three great centers—the cardiac, solar, and hypogastric.

In the human body there are 12 pairs of nerves connected with the head and 31 pairs connected with the spinal cord. Those connected with the head are more complex.

It is interesting to know that the nerves grow in the same direction that the message is to travel. For example, the optic nerve (which carries an in-going message) begins to grow at the retina and grows in toward the brain; while the motor nerves (which carry out-going messages) begin at the nerve centers and grow toward the outside of the body.

Nerves make their first appearance in the animal kingdom among the jelly-fish. The lower forms of life do not have such specialized apparatus for receiving and sending messages. (*See* Brain.)

LITTLE HOLLAND'S PICTURESQUE LAND *and* PEOPLE

Extent—North to south, 210 miles; east to west, 120 miles. Area, about 13,000 square miles, exclusive of gulfs and bays. Population, about 6,800,000. Colonies: Java and other islands of the Dutch East Indies, Dutch Guiana in South America, and Dutch West Indies (Curaçao, St. Eustache, part of St. Martin, etc.). Area of colonies, 735,000 square miles; population, about 47,000,000.

Physical Features.—Level surface, with almost all of coastal portion below sea-level and protected by dikes. Zuider Zee, an arm of the North Sea (2,027 square miles); mouths of Rhine, Maas (Meuse), and Scheldt rivers; and numerous canals.

Products.—Butter and cheese, flower bulbs, rye, oats, potatoes, and sugar beets; herring and oysters; peat and pottery clay; manufactures of pottery (especially Delft ware), refined sugar, cocoa and chocolate, ships and boats.

Chief Cities.—Amsterdam (about 648,000), Rotterdam (507,000), The Hague (capital, 360,000), Utrecht (139,000), Groningen, Haarlem, Arnhem, Leyden, Nimeguen, Tilburg (more than 60,000).

NETHERLANDS, KINGDOM OF. A little country about the size of Massachusetts and Connecticut together, the Netherlands — popularly called Holland from its chief province—consists of the delta land of three great rivers, the Rhine, the Meuse (or Maas, as the Dutch themselves spell it), and the Scheldt. Almost half of the land, including the three largest cities, Amsterdam, Rotterdam, and The Hague, lies below sea-level. The shores of sea and rivers alike are diked, and thousands of windmills with ladder-like sails are kept busy pumping water back into the sea. The dikes must be carefully built and carefully guarded, for Holland had its warning more than 500 years ago when the North Sea swept into the very heart of the country, covering hundreds of towns and villages and forming the Zuider Zee. Formerly a small inland lake, this is now a shallow bay 80 miles at its longest, 45 miles at its broadest, and with an average depth of 12 feet. A law passed in 1918 provides for reclaiming much of this area by damming and draining it. Besides its coast-line of 200 miles, the Netherlands has a network of river mouths and more than 2,000 miles of canals—only 500 miles less of canals than the country has of railroads. (For map, *see* Belgium.)

When you visit Holland you will think that it looks like no other country in the world—with its flat meadows, its canals with their barge population of 50,000 to 100,000 who live their whole lives in those quaint boats with bright red cabins and miniature gardens, its storks, its windmills, and its red-roofed villages. Black and white cows speck the meadows, some wearing garments to keep out the cold; and the more aristocratic eat from mangers lined with red and green tiles.

The people of Holland are as attractive as the land. The Dutch are known the world over for their quaint costumes varying with the districts—the wooden shoes and baggy trousers of the farmers, and the queer neat caps worn by the women in many provinces. In the cities, however, they look like the best and most alert type of Englishman, well dressed and well educated, with clear ruddy complexions; and often they speak English almost as well as Dutch, for trade and travelers have made the Dutch business man of necessity the master of several languages.

Today the Netherlanders are a commercial nation, dealing in coffee, cocoa, chocolate, and tropical spices from their wide colonial possessions in the East Indies (*see* East Indies), the West Indies, and South America. Holland once possessed a greater colonial empire than England, and still numbers colonies which are in area more than 50 times greater than the little land that rules them. Holland's home industries include the

DRESS IN THE LAND OF THE DUTCH

The first three pictures illustrate the varied dress worn by the Holland peasants. The two women with the shoulder "wings" (1) are from Walcheren, the westernmost of the islands of the Netherlands. The man and his wife (2)—both in their dress-up clothes—are fisher folk from Scheveningen, a fashionable watering place. The two girls in the center (3), with their typical Dutch caps, are from Haarlem. The bottom picture (4) shows the interior of a Dutch home on the island of Marken. The houses of the Dutch, no matter how poor, are always clean and attractive.

contained in the Easy Reference Fact-Index at the end of this work

IN THE GREAT DUTCH CITY OF ROTTERDAM

Would you imagine from this picture that some of the principal "streets" of Rotterdam are canals? In the middle distance there you can see a bridge over one of them. Rotterdam, situated on a branch of the Rhine-Meuse delta, is one of the greatest of the world's seaports, receiving not only a great amount of sea traffic but a vast quantity of canal shipping. The public buildings, built in modern style, form an interesting contrast to the quaint houses with wooden gables that belong to older days.

making of butter, either fresh or in tins, and great round cheeses painted red or left yellow and oiled. The Dutch have in times past gambled in tulips as our own financiers gamble in stocks; and these, together with hyacinths and other bulb plants, form as important an industry as the raising of vegetables. At Amsterdam you will find the world's most famous diamond cutters.

Almost everywhere in Holland the past is as much with you as the present. There are great Gothic or Renaissance cathedrals many times too large for the now shrunken towns, and almost always whitewashed to conform to the Protestant religion for which they are now used. You also find many old town halls, and weigh-houses where for hundreds of years the cheeses have been weighed. Everywhere are definite landmarks of the Spanish tyranny over the Netherlands, of Prince William the Silent, and of Holland's brave struggle toward a republic. In art as well as in architecture the past is represented, for the art galleries of even some of the smaller cities of Holland are the envy of some of the greatest capitals of Europe, not only for their collections of the Dutch school, Rembrandt, Gerard Dou, Frans Hals, Jan van der Meer, Ruysdael, Hobbema, and others, but of the schools of France and other lands as well. And you will be shown the houses of Holland's saints, philosophers, and scholars—Thomas Kempis, Erasmus, Spinoza, and Grotius.

"LITTLE OLD MEN"

Many Dutch children wear exactly the same costume, on a smaller scale, as their elders. Here we see the famous long baggy trousers, caps, and wooden shoes which mark the old-fashioned Hollander.

No matter how long you stay in Holland or how clearly you know that it is a small country, you will continue to be surprised that its great cities are so near together; some of them not so far as an American city from its suburbs. If you go to Holland from England you will be landed at the Hook of Holland at daybreak, and before breakfast time you will be at Rotterdam. From there a ride of an hour and a half on a Maas steamboat will take you past fisheries, shipbuilding yards, meadows yellow with marsh marigolds, to the much painted city of Dordrecht whose four rivers and the connecting canals will remind you of Venice. Dordrecht was once the richest town in Holland, and it is still one of the most beautiful, a favorite with painters.

A little steam barge will take you by canal from Rotterdam to Delft, once famous for its potteries,

For any subject not found in its alphabetical place see information

TULIP BEDS AND TULIP BULBS

It seems a pity, doesn't it, to throw away all those pretty tulips, but the flowers are raised for the sake of the bulbs, and the whole family, you see, including girls like that little tot, help to keep out the weeds. Then, when harvest time comes, the bulbs are pulled up, stored in bins (as shown on the right), and great heaps of the beautiful flowers and their stems are piled up in the corners of the fields and allowed to rot, so that they may be put back again to fertilize the land.

now for its quiet picturesqueness and for the fact that it contains the tombs of William the Silent and Grotius. Not far north of Delft lies The Hague, the capital of Holland. From there you will want to walk or ride down the old road to Scheveningen, once a simple fishing village which could boast quaint costumes, now a fashionable watering place; and to the quaint old university town of Leyden, which for its bravery under Spanish siege in 1574 was offered by William the Silent a choice of exemption from taxes or a university, and chose the latter. If you happen to be there in April you will want to make the two-hour rail journey to Haarlem in the heart of the tulip country. For mile after mile you ride through flat lands carpeted with squares of red, yellow, white, and purple tulips and hyacinths. Great heaps of the bright flowers are piled up in the corners of the fields to be used as fertilizer, for the bulbs and not the flowers are sold.

The Cities of Holland

At Haarlem you are only ten miles by train west of Amsterdam, but for that matter it would have taken you only an hour and a half to make the direct railway journey straight through from Rotterdam. From Amsterdam there are many little journeys to be made to the island and village of Marken, in the Zuider Zee, where the fisherfolk with their quaint costumes make as much money from tourists as from fish; to Edam, the home of red cheeses, and once the water-gate of Amsterdam, before Amsterdam had a North Sea canal; to Alkmaar, where every Thursday afternoon the boats from neighboring farms unload their yellow cargoes, flinging the cheeses about like enlarged baseballs, to be sold at the famous Friday cheese market. Only 42 minutes by train from Amsterdam and 35 minutes from Rotterdam lies Utrecht, "the city of spires" and also of bridges—95 of them at a conservative count. It was here that the northern provinces organized their resistance to Spain in 1579, and that the peace treaty between France, England, and Austria was concluded in 1713. From Utrecht an hour's ride will take you to the least Dutch of Dutch cities, Arnhem, lying above rather than below sea-level, a district of wooded hills.

But whether it is above them or below them, water is always around the Dutch and when it does not seek them they seek it—on barges and canal boats, on fishing smacks and ocean liners, and at home, where floors and doors and sidewalks are flooded and scrubbed and sanded until it seems as though the busy housewife would wash away the very foundations of the little land.

The Holland of History

In the Middle Ages the present kingdoms of Belgium and the Netherlands were a group of disconnected counties, duchies, and other feudal districts, some of them forming part of France and some part of the Empire. Gradually these passed into the hands of the Burgundian dukes; and Charles the Bold sought unsuccessfully to weld them together and create of them a border kingdom between France and Germany (*see* Charles the Bold). The marriage of his daughter Mary to Maximilian of Austria brought the Hapsburgs to rule over the "Low Coun-

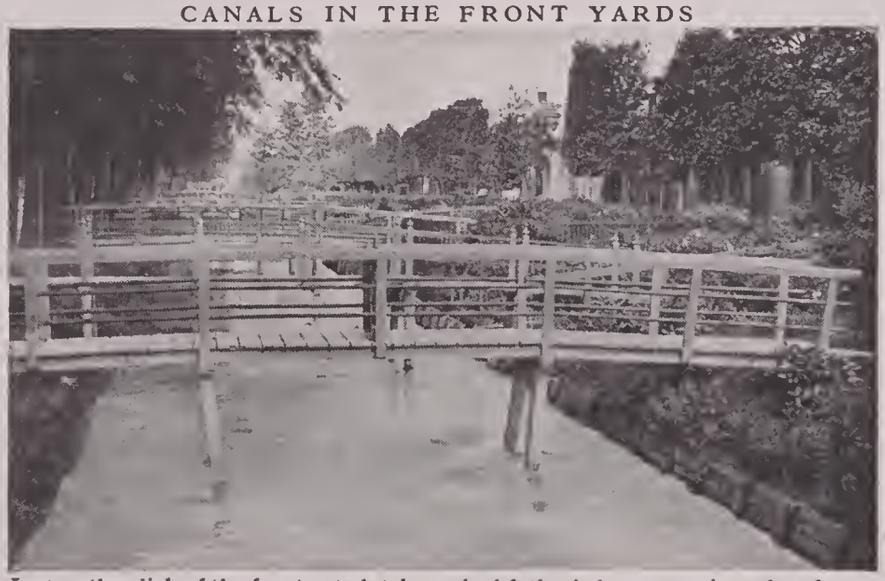
ONE OF THE GREAT DIKES THAT HOLD BACK THE SEA

Aren't they massive structures, these Holland dikes? But, of course, they have to be. It's a big job to keep the sea from breaking through! When gales rage at sea the giant waves batter them with incredible force. See the great old-fashioned windmill on the dike, a type still common in Holland.

tries" (Netherlands), as this whole group of territories was then called. On the abdication of the Emperor Charles V in 1556, they passed to Philip II of Spain.

Against the political and religious tyranny of Spain, culminating in the infamous rule of the Duke of Alva and his "Council of Blood," an armed revolt began in 1568. But the ten southern provinces were Catholic in religion, while the seven northern ones were Protestant, so divisions crept in. In 1579 the Protestant provinces formed the separate Union of Utrecht, and thenceforth were usually called the United Provinces, or the Dutch Netherlands. In 1581 they issued their formal declaration of independence. In 1609 Spain signed a truce virtually acknowledging the provinces as independent, but formal peace did not come until the Treaty of Westphalia (1648).

CANALS IN THE FRONT YARDS



Just as the click of the front gate latch marked father's home-coming when fences were popular in America, so a familiar tread on one of these little bridges announces the home-coming of many a Dutch burgher. Each bridge connects a house on the right with the road behind the trees on the left.

Until the Dutch wars with Great Britain (1651–54 and 1665–67), the United Provinces was the greatest commercial and maritime state in the world. The attempt of Louis XIV of France (in 1672–78) to conquer the Netherlands also inflicted a serious blow to the provinces. The aristocratic republic definitely ended and the office of "stadholder" became hereditary in the house of Orange in 1747. When the wars of the French Revolution broke out, the French revolutionaries overthrew the rule of the house of Orange and made the Netherlands again a republic (1797). Napoleon set his brother Louis over it as king (1806–10), but later felt obliged to annex the land directly to France. The Congress of Vienna restored the Netherlands as a kingdom under the house of Orange, and added to it the southern provinces (Belgium) in an ill-mated union. This connection ended when Belgium revolted, in 1830, and set up as a separate kingdom.

Slavery in the Dutch West Indian possessions was abolished with compensation to the owners in 1863. In 1890 the death of King William III without sons brought to the throne his little daughter, Queen Wilhelmina. The government is a constitutional monarchy, with a Parliament of two houses directly elected by universal suffrage, women voting as well as men. The executive power is exercised by a cabinet and a prime minister, responsible to Parliament. In the great World War the Netherlands maintained its neutrality, but suffered severely in trade and in other ways. At the close of the war the defeated German emperor was allowed to find refuge in the Netherlands.

How the Ocean Saved Leyden from the Spaniards

LONG, long ago—more than 300 years, in fact—grim fierce Spanish soldiers were besieging the quaint Dutch city of Leyden. For days and weeks and months they had surrounded the city. The people within were starving. All day and all night the babies cried for food, but there was no bread left in the city. Hans and Gretchen sacrificed their pet dogs to feed the people. The leaves were all picked from the trees and eaten. But still the people would not surrender to the Spaniards, who were seeking to restore the hateful rule of the Spanish king and to put down with fire and blood the Protestant religion.

Then one day carrier pigeons flew in to the besieged city. On their legs were found messages from the brave leader of the Dutch, William of Orange, saying that the dikes which held back the ocean had been cut and the ocean was coming to drown out the besiegers. Oh, how the people rejoiced! They fired cannon and beat drums to show their joy.

When the Spanish commander learned that the dikes had been cut he was afraid. But his officers laughed at his fears. "William of Orange may rule the hearts of his countrymen," they said, "but he cannot rule the ocean as well. No one but a crazy man would think it possible to call the sea from its bed across 22 miles of level land to the walls of an inland city."

In the center of Leyden, on its highest point, stood a tower. Many times a day the people climbed to the top of this tower, straining their weary eyes seaward to discover the ocean coming to their help. They could not see it, and hope grew faint as day after day wore away and no one outside Leyden seemed to remember them.

At the end of August the pigeons carried to their brave leader, William of Orange, a message of despair from Leyden. "We have surely been forgotten," they wrote. "If help does not come soon, we must all perish." Back came the cheering answer, "Rather will we as a whole land and all our possessions perish in the waves than forsake thee, O Leyden."

And it was true. The Dutch were busy collecting ships and supplies to help the suffering people. At last all was ready and the fleet set sail. Over the new sea made by cutting the dikes the ships sailed until they were only five miles from the city. But here they were stopped. The water was too shallow for the ships. The wind was against them, too, for it blew steadily from the east and drove the water back toward the ocean instead of heaping it up into an inland sea.

In Leyden things were at their worst. The people knew that their fate depended on the wind. Their eager eyes were fastened on the weather-vane and earnest prayers were sent up that the wind might change. But still the vane pointed obstinately to the east. If help did not come soon it would be too late. Scores were dying every day. Rats and mice had grown to be delicacies.

The Spaniards threw their taunts into the city—"As soon expect the Prince of Orange to pluck the stars from the sky as to bring the ocean to the walls of Leyden." Immediately the brave men of Leyden sent back the bitter retort, "Ye call us dog-eaters, and it is true. So long then, as ye hear dog bark or cat mew within the city, ye may know that the city holds out."

Then from the northwest came a wind which freshened to a gale, veering around to the southwest. The waters of the North Sea were driven and thrown madly landward, and poured through the gap cut in the dikes.

In a few hours the water about the rescuing vessels had deepened. On the fleet sailed, through the branches of drowned orchards and the chimneys of buried cottages. It was midnight, pitchy black, and with the storm howling on every side. Somewhere in this blackness the Spaniards were fleeing before an enemy that they could not fight. Many were caught by the advancing waves. In Leyden there was no sleep that night, and early the next morning all were out to see the fleet sail up to the city walls. The starving people rushed to the wharves, snatching the bread thrown them from the vessels. It was the first wholesome food they had tasted in two months.

The burst of welcome over, everyone fell into solemn procession and turned toward the great church to thank God for his wonderful deliverance. As a reward for the city's courage, William of Orange offered its brave people their choice of a grant for a university or an exemption from taxes. They chose the former, and the University stands today as a monument to their bravery.

NETTLE. The nettle plant has a bad reputation, for the stinging hairs with which it is covered pierce the skin when touched and give forth an acrid juice which often causes much inflammation and pain. If, however, one is careful to grasp the weed in such a way that the hairs are pressed to the stem, no pain ensues.

The nettles proper are annual or perennial herbs with occasionally shrubby bases, and make up the genus *Urtica*. Several trees of different genera, especially the giant nettle of Australia, are given that name. Two species native to Europe, the small nettle and the great nettle, are now abundant in America.

In many countries nettles when boiled have a special value as food for swine and poultry. The roots boiled in alum produce a yellow dye, and the stalks and leaves give a beautiful green dye. The fibers of different species are used for making rope, yarn, cloth, and even lace. (*See* Weeds.)

RUGGED NEVADA, RICH *in* TREASURE

Extent.—North to south, 484 miles; east to west, 318 miles. Area, 110,690 square miles. Population (1920 census), 77,407.
Physical Features.—Numerous mountain ranges from 7,000 to 10,000 feet in height, running generally north to south; highest point, Mount Wheeler (13,058 feet) on eastern boundary. Humboldt River in northern part of the state, flowing into Humboldt Lake; numerous small streams which evaporate in the dry season. Lakes Pyramid, Tahoe (on California border), Walker, and Carson (in west), Ruby and Franklin (in east); all without outlets to the sea.
Products.—Copper, silver, gold, lead; live stock and wool; hay; lumber.
Principal Cities.—Reno (13,000), Carson City (capital).

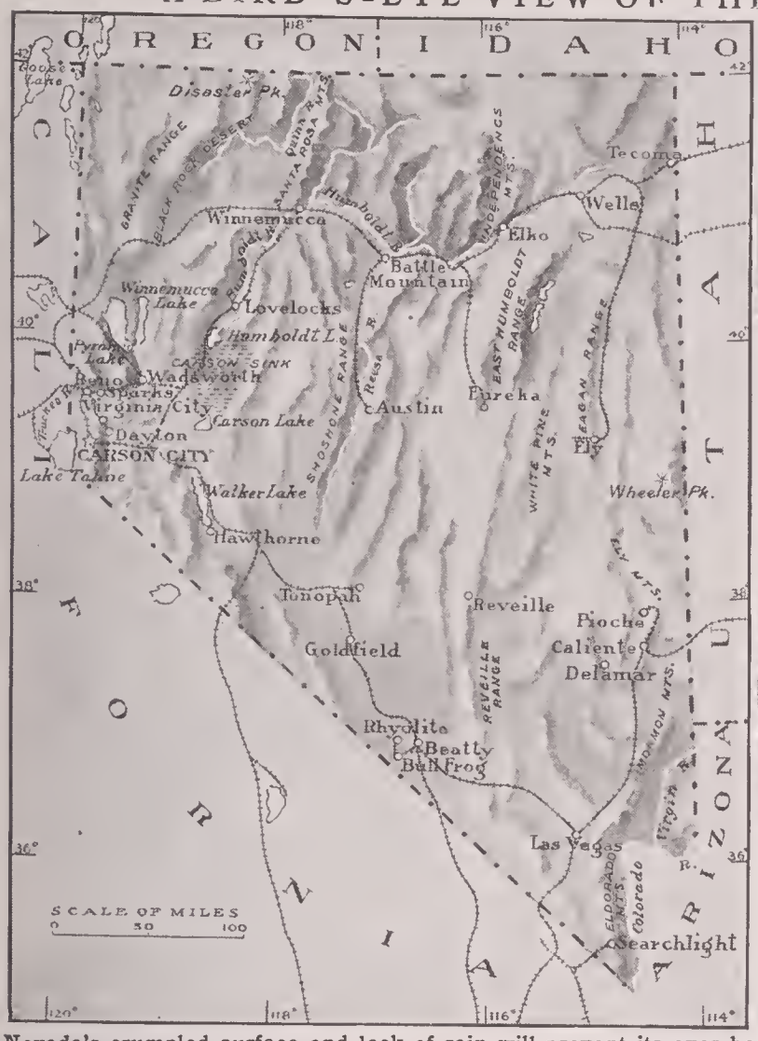
NEVADA. Though it is the sixth largest state in the Union, Nevada, the "Sage-Brush State," has the smallest population of any state. There are 90 cities in the United States each of which has more inhabitants than the whole commonwealth of Nevada. By the dry winds which blow over her, and the white alkaline dust which sparkles upon her, a large portion of Nevada seems condemned to loneliness and a scanty population, especially since the decline of mining. The lofty Sierra Nevada range, whose snowcapped summits form the western rim of the Great Basin within which nearly all of Nevada lies, intercepts the breezes from the Pacific and steals their moisture, so that the rainfall is only about ten inches a year. Practically all of this falls in the winter in the form cf snow on the mountains. The great length of the vast table-land which makes up Nevada, nearly 500 miles, and its varied elevation—from 1,000 feet in the south to 6,000 feet in the north, with occasional peaks of 10,000 to 13,000 feet—give it almost as great variety of temperature as California, ranging from semi-tropical in the south to almost continuous cold in the high valleys and on the mountains. Here and there appear picturesque mountain peaks, with snowcrowned summits glistening in the sun (whence the name of the state, Spanish *nevada* meaning "snowy"); but the greater part of the surface is made up of stretches of sagebrush, sand, and alkali wastes.

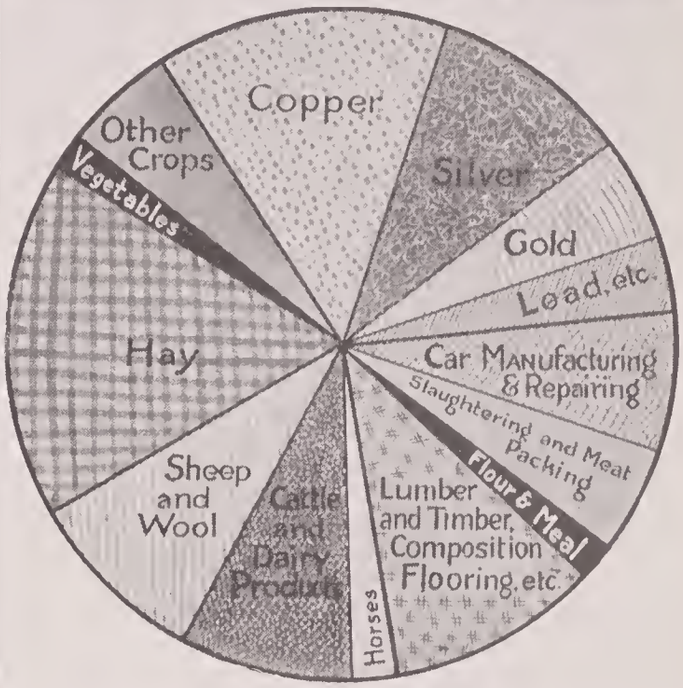
Most of the small streams flow only in the wet season, and little of the waters of any of the rivers reach the ocean. They are lost in the soil or evaporate from fleeting lakes, which are formed hastily on valley floors and hastily sipped away by the dry winds, leaving hard cakes of mud or a sparkling white coat of salt. The permanent lakes have no outlets and all are more or less brackish. Where fresh water reaches it, however, the thin alkaline Nevada soil is surprisingly fertile. About a million acres out of the more than 70,000,000 acres of the state are under cultivation. Nearly all of this is irrigated, though dry farming is practiced in limited areas. The land is so productive that Nevada stands second among the states in the wheat yield per acre, and stands near the top in the acre yield of alfalfa and barley. The irrigated valleys also produce bountiful crops of apples and other orchard fruits, small fruits, and vegetables. Tropical fruits such as figs, almonds, grapes, pomegranates, and Egyptian cotton thrive in the extreme southeast, in the Colorado River basin. But Nevada will never be a great farming state. The water supply is so scanty that even when it is all brought under control only about 600,000 acres will be added to the productive area. Chief of the irrigation systems to which the state owes such agriculture as it possesses is the Truckee-Carson project, which has reclaimed about 200,000 acres.

Nevada is, however, an important stock-raising state, for various forage plants flourish on its immense cattle ranges. Efforts are being made to expand the cattle, sheep, and dairying industries by improving and reseeding the public ranges, and increasing the amount of forage grown on the cultivated lands by intensive cultivation. Lumbering is also a considerable industry. Fir, spruce, and pine grow tall and

For any subject not found in its alphabetical place see information

A BIRD'S-EYE VIEW OF THE "SAGEBRUSH STATE"





Nevada's crumpled surface and lack of rain will prevent its ever becoming a great farming state. Its herds of cattle and sheep, however, supply nearly as great a proportion of its wealth as do the copper, silver, and gold mines. A glance at the round graph at the right will show you the relative value of the state's products, while above that is indicated how the population is divided into religious denominations. The climate of Nevada, while extremely dry, is healthful and invigorating and the scenery is unsurpassed.

green on the higher slopes of the Nevada mountains, and mountain mahogany, willow, beech, cottonwood, wild cherry, and dwarf cedar cover the foothills. Some of these mountains, and the clear blue lakes among them, especially Lake Tahoe, which lies partly in Nevada and partly in California, are very lovely and attract throngs of tourists.

The real wealth of the state is dug out of her bleak and rocky soil, where rich veins of gold and silver are woven into the dull stone, as if to compensate for the dreariness of the prospect above ground. The Comstock Lode is one of the most famous of the world's treasure-stores. It was discovered in 1859, and to it Virginia City chiefly owes its growth. This great pool of gold and silver, in its heyday, yielded as much as $10,000,000 worth of precious metal annually, and it has produced a total of more than $400,000,000. The shaft goes down 2,300 feet, but miners can no longer venture into these extreme depths. This is because of the great heat (120° F.) and the stifling gas generated by the action of the air on the sulphurous rock which the shaft cuts through here and there.

More recently gold mines have been pouring out treasure at Goldfield, Tonopah, and Rawhide. Besides gold and silver, other minerals of value are mined—copper, lead, mercury, nickel, salt, sulphur, borax, and many others. Fine building stone is also quarried—marble, granite, limestone, and sandstone—and semi-precious gems, such as amethysts, tourmalines, and carnelians, are occasionally found.

With so few people in this great lonely state, there is not much manufacturing. A few flour and grist mills, sawmills, packing-houses, dairies, beet-sugar factories, chemical plants, and railroad repair shops comprise most of the state's manufactures, aside from her great smelting and refining works.

Reno, in the western part of the state, is the largest city and seat of the state university. Nevada's manufactures center there, and in Carson City, the capital, 25 miles south, and Virginia City, 18 miles southeast. Ely, in the east, and Tonopah and Goldfield, in the southeast, are the other chief towns—none of them, however, reaching the 5,000 mark in population.

There are two considerable Indian reservations in Nevada—Pyramid Lake and Duck Valley, the latter partly in Idaho, besides several smaller reservations. The Indians number more than 5,000, and belong to the Piute, Shoshone, and a few other tribes of the old Shoshonean stock.

contained in the Easy Reference Fact-Index at the end of this work

BUCKING THE SNOWS IN NEVADA

Here you see one of the exciting moments of a winter railway trip over the Nevada Mountains. This train on the Virginia and Truckee Railway has an extra engine equipped with a snow plow to help it get through the drifts along the right of way.

Nevada was part of the territory acquired from Mexico in 1848, at the close of the Mexican War. The first white man to cross its area is believed to have been Francisco Garcés, a Franciscan friar, in 1775. Certainly Peter Skene Ogden, the vigorous old trapper of the Northwest, wandered across Nevada in 1825, and in 1826 Jedediah Smith went pioneering across the state. Not until 1849 was a permanent settlement made, when a trading post was established by the Mormons near the present village of Genoa.

In 1850 much of Nevada was included in the new territory of Utah. With the discovery of the Comstock Lode, in 1859, began the rush to the mines.

Placer mining in California had given out, and by 1860 miners and their caravans of outfits crowded the trails leading to the Carson River valley. The adventures of Aladdin and the Count of Monte Cristo faded into humdrum insignificance beside the changeable fortunes of Nevada fortune-hunters. "Lucky Baldwin," turned out of his room one Saturday because he could not pay his rent, was a millionaire the next Saturday. After 1877, however, the Comstock lode began to give out and mining declined until revived by the discovery of new fields at Tonopah, Goldfield, and other places in 1906 and after.

Nevada was admitted to the Union as a state in 1864, the deciding reason which impelled President Lincoln and Congress to confer statehood on this scantily populated region being the need of another loyal state to make certain the passage of the 13th and 14th amendments to the Constitution.

THE MACKAY SCHOOL OF MINES

John W. Mackay came to New York a poor Irish boy and was always proud of the fact that he began his career in the West, where he made his fortune as a common miner. So in this statue of him, which stands in front of the School of Mines given to the University of Nevada as a memorial by his widow and son, he is represented with his miner's pick.

For any subject not found in its alphabetical place see information

The Dream of Chief Winnemucka

LESS than a hundred years ago, the only inhabitants of what is now the state of Nevada were a few tribes of Indians. Among these was a tribe of Piute Indians who lived on the shores of Pyramid Lake and along the banks of the Truckee River. They were shut away from the world on all sides by deserts and mountains. Three hundred and fifty years after Columbus found America, they had never seen a white man.

Few animals or food plants could live in that dry country, so the Piutes were very poor. But they had a beautifully sheltered valley for a home. The lake was salty, like a little sea, and 20 miles wide. Thousands of wild ducks nested around it every spring. Truckee River was full of speckled trout. "Truckee" is the Piute word for "all right," and it certainly was as good a little river as could be found anywhere. Grass and roots and bushes grew along its banks; so for a part of the year antelope, jackrabbits, and the Indian ponies had plenty to eat. By hunting with bows and arrows, and fishing with nets made of wild hemp, the Piutes could just manage most of the time to get enough food and clothing. Some winters they had nothing to eat besides the pine nuts or seeds that they gathered in the thin mountain forests of the region.

The Piutes had a wise, kind old chief. His name was Winnemucka. He told his people to love peace, tell the truth, never to steal from their poor neighbors, and to be kind to children and to the old and helpless. Sometimes he told them of wonderful dreams that he thought came from the Great Spirit who lived in the sky.

Now, while it was burning hot in that country in summer, the winters were cold and stormy. One hard winter the snow lay deep on the mountains, bitter winds blew, and the river was frozen. For weeks the poor Indians shivered in their rude huts and lived on pine nuts. Then spring came suddenly. Soon the grass was green. There were flowers, too. The wild blossoms of the desert were so pretty and sweet smelling that little girl papooses were named for them. Chief Winnemucka had a little granddaughter who was named Tocmeto'ne, or "Flower of the Wild Mint."

Chief Winnemucka Tells His Dream

That year, when their name-flowers blossomed, the little girls made wreaths and necklaces of them, and danced the flower dance. After the dance was over and the flower songs had been sung, Chief Winnemucka called his tribe around him. They all sat in a circle, around a fire, on the ground. Tocmetone sat on her grandfather's lap, while he told a wonderful dream he had had.

"Last night the Great Spirit brought me a beautiful dream. I saw strangers on the mountains. They rode very large ponies. They were clothed all over, and not in rabbit skin aprons and antelope cloaks, like us. Their eyes were pale, their skins were red and white. They spoke strange words. They had long sticks with which they made thunder and lightning. They were bold brave men. By and by they will come. And they will need our help. They will not know how to find food and water in the dry land. We must welcome our white brothers and see that no harm comes to them."

It was strange, but that very summer a party of white fur traders came from the North. The Shoshone Indians of Idaho had told them of the desert tribes. They rode horses. From a mountain ridge they looked down on the beautiful sea-green sheet of water of Pyramid Lake. Chief Winnemucka saw them at once, for he had been expecting them. With a loud, joyful cry he sprang forward, crying—

"The white brothers of my dream!"

How the White Men's Hearts were Won

He had 20 of the best ponies brought in. The squaws trimmed the manes and tails of the animals with wild flowers and cedar sprigs, to honor the strangers. Then the chief and his handsomest young braves rode up the mountain with shouts of welcome.

The white men did not understand this at all. They thought these wild-looking nearly naked Indians meant to attack them, and so fired their guns. The Indians were startled by the "thunder and lightning sticks," but they did not run. Chief Winnemucka got down from his pony. He laid his bows and arrows on the ground and spread his arms wide in sign of peace.

Still the white men would not trust him. They motioned him to go away. Winnemucka was sad. Then he sent some of his braves to kill an antelope. He laid the game on the ground for a present, and made his camp far away.

Day after day Winnemucka followed the white men. Every evening he left a present of game, where they could see it and come for it. By signs he pointed out trails and water holes and good camping places. At last he won their trust and friendship. When they invited him to sit at their fire and share their food he was happy. He made a feast for his white brothers. He learned a few of their words.

These poor Indians had nothing to sell, so the fur traders did not come back. But a few years later Gen. John C. Fremont, of the United States Army, came with a big party. This famous surveyor and explorer was called "The Pathfinder." He spent years in traveling over the wild trails of the Great West, where few white men had ever journeyed before. When he rode down into the valley of Pyramid Lake he was surprised to have Chief Winnemucka run to him and cry: "Welcome, white brother!"

General Fremont thought so much of Winnemucka that he called him after the Truckee River—"Chief

All Right." He took him across the Sierra Nevada Mountains with his party. The desert Indians had never tried to cross that lofty range, which for hundreds of miles lifts its snow-capped peaks to the clouds. Winnemucka had never dreamed of such a land as the forested slopes, green valleys, and sunny coast of California.

As fast as he could travel Winnemucka went back home. He told his people of the gardens and orchards, the wheatfields, and the pastures with their flocks and herds of cattle. He told them of the workshops and iron tools, and of the schools for children established by the good Fathers of the Spanish Missions. White men and red lived there together, in peace and plenty. No one burned or froze, or starved or went naked, in that wonderland that was like the land of the Great Spirit.

The next year Winnemucka took 30 families of his tribe to California. He put his little granddaughter Tocmetone in a convent school. While the chief herded sheep for the Mission Fathers, Tocmetone learned to be a good Christian. She was the brightest of all the Piute children. She soon learned to cook and sew, and to read Spanish and English. She had pretty clothes, like white girls. By and by the church gave her two names: Sarah Winnemucka. She and her grandfather were proud of that. But he had a new English name for her. It was "Sweetheart."

"Sweetheart," he said, "you have a better mind and heart than your brothers. You must grow up fast, and learn all you can. So when I go to dwell in the land of the Great Spirit, you can make the speeches, and write the letters to keep peace between the poor Piutes and their white brothers. They fight sometimes, because they do not understand each other. And some white men and some red men are bad and selfish."

So Tocmetone went back to Pyramid Lake with her grandfather. When he died of old age, she was grown up. Many white miners were coming into the country to hunt for gold and silver in the mountains. They shot all the game and seined the little rivers for fish. The poor Indians were in danger of starving. They wanted to go to war; but Princess Tocmetone told them the words of her good grandfather.

There was then a governor of Nevada appointed by the president of the United States, and a fort with soldiers on Lake McDermitt. Whenever there was trouble, the Piute princess rode her pony to the fort. She always told the truth; she kept her tribe in good order; and she had only peace and friendship in her heart for the white men. So she was loved and trusted by everyone. By and by she brought her tribe to live near the fort. The government kept her there as a peacemaker.

When Tocmetone was very old she said that she had never forgotten her wise kind old grandfather's beautiful dream. She had helped the Great Spirit to make it come true, for red men and white men dwelt together in peace.

NEWARK, N. J. Situated only eight miles west of New York City, and connected with it by "tubes" or subways under the Hudson River through which electric trains carry tens of thousands of "commuters" to the metropolis each day, Newark lives under the shadow of its great neighbor. Nevertheless the city has kept a distinct character of its own. Within its borders are several thousand factories, in which more varieties of goods are produced than in any other city of similar size. It is the largest city in New Jersey. The Passaic River, which enters Newark Bay, furnishes an important water route to the ocean, and to a certain extent Newark shares with New York the advantages of the greatest harbor in the world. In the course of the World War, Port Newark Terminal was completed, transforming a formerly useless tidal meadow into a great shipping, shipbuilding, and manufacturing community.

Newark is an old city with an interesting history. A handful of Puritans from Connecticut, under Robert Treat, founded it in 1666, buying from the Indians what is now Essex County for the equivalent of a few hundred dollars. As an honor to their pastor, who came from Newark-on-Trent, in England, the settlement was given its present name, having first been called New Milford. In recent years the city has grown with remarkable swiftness. It has become the largest jewelry manufacturing center in the country, and has attained a world-wide reputation for leather manufactures, leading in the making of patent leather. The smelting and refining of copper, the manufacture of foundry and machine-shop products, electrical machinery and supplies, celluloid, automobile paints and varnishes, and chemicals, represent other important industries. The nationalities, tastes, and customs of its wage-earners also vary greatly, making Newark one of the most cosmopolitan cities of its size in the country.

Newark is a city of wide streets and splendid parks, and has an excellent educational system. The famous bronze statue of Lincoln by Gutzon Borglum, facing one of the city squares, shows the president seated on a bench in one of the darkest hours of the Civil War. Children have climbed upon the lap of the sad kindly figure so often that they have worn the knees shiny. Population, about 415,000.

NEW BEDFORD, MASS. The Massachusetts state capitol once had a codfish for a weather vane. The City Hall of New Bedford in the old days should have mounted a whale, if anything so bulky would do similar service, for all the traditions of New Bedford are connected with the whaling industry. In the public library you will find the largest collection of books on whaling, the finest whaling prints in the world, and in the Bourne Museum you may even see a full-rigged whaling vessel. Indeed, this city was

long the principal whaling port of the world. The industry began as early as the middle of the 18th century and by 1765 wharves and warehouses had been built. Whales were first hunted off the Virginia and Carolina coasts, and later in West Indian and South American waters. After 1791 the whalers regularly rounded Cape Horn into the Pacific. Arctic whaling, in 1848, began a new era of prosperity for the trade, and in 1857 New Bedford had 329 registered whaling ships. Then with the discovery of oil in Pennsylvania, whale oil was no longer widely needed as an illuminant, and the industry waned.

New Bedford is on the Acushnet River at the head of Buzzards Bay, 56 miles south of Boston, and it is the fifth largest city of Massachusetts. Today its prosperity is based on cotton. In the manufacture of fine cotton yarns and cloths it stands ahead of all other cities of the United States. The mills employ nearly 40,000 persons and use almost half a million bales of cotton every year. New Bedford also has one of the largest twist drill plants in the world. Other industries include the manufacture of silk yarns and cloth, fine tools, dies, silverware, shoes, rope cordage, and paper goods.

New Bedford was settled in 1652, and incorporated as a city in 1847. During the Revolution it sent out many privateers and was attacked and captured by a British fleet and almost burned to ashes in 1778. Population, about 122,000.

NEW BRUNSWICK, CANADA. Nature and history have combined to cut off New Brunswick, Nova Scotia, and Prince Edward Island—the three Maritime Provinces—from the rest of the Dominion of Canada. The northern projection of the state of Maine thrusts far up between New Brunswick and southern Quebec. Thus the only communication by land is either across the territory of the United States or by a roundabout route. Despite these drawbacks, the importance of the ice-free harbors of St. John, New Brunswick, and Halifax, Nova Scotia, as winter outlets for the grain of the Northwest has led to the construction of three railroad lines linking the Maritime Provinces to the rest of the Dominion—the Intercolonial and Transcontinental, all on Canadian soil, and an extension of the Canadian Pacific from Montreal across the state of Maine to St. John.

Lying between the Gulf of St. Lawrence and the Bay of Fundy, New Brunswick contains less than 28,000 square miles. Its population of about 352,000 is not increasing, for few new settlers come to New Brunswick, while many of the more ambitious of the younger generation move westward, lured by the great wheat fields of the plains. More than 70 per cent of the people of New Brunswick live in the country, and agriculture is the leading industry. The chief crops are hay and potatoes. Of recent years dairying and cattle-raising have increased.

These pursuits are carried on on the outer edge of the province, the center of which is all one vast forest. Lumbering is the second industry of importance; and scarcely a stream of the network of rivers which covers New Brunswick but has its sawmill. The manufacture of pulpwood is becoming increasingly important, and there are several cotton factories. Coal is found in several parts of the province but much of it is in seams too shallow to be workable. Natural gas and oil are exploited on a small scale.

But New Brunswick's chief fame is as a summer playground. It is one of the favorite resorts of the angler and the hunter, for its streams swarm with salmon and other fish, and in its great forest are all kinds of game, both large and small—moose, caribou, deer, wolves, foxes, otters, mink, rabbits, geese, ducks, and partridges. The fisheries along the 600-mile seacoast are also valuable, ranking next to those of British Columbia, Newfoundland, and Nova Scotia.

The first settlement was made by the French on the Bay of Chaleur in 1639. The territory, combined with Nova Scotia under the name of *Acadie*, was ceded to the English in 1713, and in 1755 many of the French inhabitants were deported (*See* Acadia).

Many of the present inhabitants are descended from Loyalists who emigrated from New England in 1784–85, though another large group is of old French Acadian stock. The chief city is St. John, Canada's principal winter port, lying at the mouth of the beautiful St. John River (*see* St. John). About 80 miles up the river is Fredericton, the capital, the center of a fertile farming region and the seat of growing manufactures. Here also is situated the Provincial University.

NEWCASTLE-UPON-TYNE, ENGLAND. "Carrying coals to Newcastle" is an ironic old saying. We appreciate its meaning when we sail up the narrow crowded waters of the River Tyne and come to this bustling city at whose docks great steamers and smutty old barges are endlessly loading coal for shipping to other places; for Newcastle is in the center of the coal regions of Durham and Northumberland, and is one of the most important coal-shipping centers of Europe. The city's ship-building yards and locomotive and engineering and ordnance works are among the largest in England. George Stephenson was born near Newcastle and the city was associated with many of the first steps in the development of the railway system. Its factories turn out (among other things) vast quantities of soda, vitriol, bleaching powder, salt and other chemical products, and also earthenware, cement, grindstones, fire brick, and refined lead. It is also one of the largest fruit and vegetable markets in Great Britain.

Newcastle was the site of an old Roman fort to defend the eastern end of the wall that Hadrian built across Britain. Its modern name of Newcastle came in the 11th century when Robert, the son of William the Conqueror, built a castle here. A century later Henry II erected the old castle which is still standing, with the walls 18 feet thick and its turrets 107 feet from the ground—a fine specimen of the Norman stronghold. Population, about 287,000.

WHERE AMERICA *is Nearest to* EUROPE

Extent.—North to south, about 330 miles; greatest width, east to west, 316 miles. Area, 42,734 square miles. Population, about 261,000.
Physical Features.—Coast broken by fiords and island-dotted bays; Anguille Range and Long Range mountains in the west and isolated peaks (highest point, 2,084 feet). Principal rivers: Humber, Exploits, and Gander. Grand, Red Indian, and Gander lakes.
Products.—Fish (chiefly cod); lumber and timber products, ship-building; iron, copper, and coal; hay, potatoes, cabbage, turnips, oats.
Principal City.—St. Johns (capital, 35,000).

NEWFOUNDLAND. The rugged rock-bound island of Newfoundland, lying at the mouth of the Gulf of St. Lawrence, the gateway to Canada, was the first land discovered by John Cabot in the New World (1497), and on that discovery in part was based England's claims to her possessions in the Western Hemisphere. The immediate result of Cabot's voyage was the growth of the cod-fishing industry which first drew the Englishmen across the wide ocean and helped to make them a nation of seafarers. As early as 1578 about 400 fishing vessels were resorting each year to Newfoundland, of which one-quarter were English.

This early importance of Newfoundland was due chiefly to the great submarine plateau called the Newfoundland Banks, which extends about 300 miles off shore and comes within 100 or 200 feet of the surface; it is supposed to be composed in part of deposits of solid matter from melting icebergs. Even today after four centuries of fishing, the Banks are still the world's greatest cod-fishing grounds. Here is an inexhaustible supply of plankton, the minute floating organisms of the sea on which the larger ocean creatures feed; and while this flood of food continues to drift down from the Pole and up with the Gulf Stream there is little danger that the cod supply will be diminished, despite all that the fishermen can do.

THE LAND-LOCKED HARBOR OF ST. JOHNS

This view is taken from one of the hills which guard the entrance from the sea, and looks northwest over the inner harbor and the city. A bend in the strait keeps storm waves out, and thus makes the bay an ideal harbor.

The cold foggy coasts of the island were not, however, favorable to settlement, and the early attempts of Sir Humphrey Gilbert (1583) and other Englishmen to found colonies met with little success. By 1634 there were about 1,750 permanent British inhabitants in the island, besides a floating fishing population of several thousands of various nationalities.

The French, who held Canada, had long attempted to secure control of Newfoundland, and though the treaty of Utrecht in 1713 recognized the sovereignty of Great Britain, France was given the right of catching and drying fish on the northern and western shores. These rights in the "French shore" were retained by France until 1904, when she gave them up in return for concessions in Africa. The Newfoundland fisheries have also been a fertile source of disputes with the United States, because of the presence of large American fishing fleets on the Banks; but these are now, in the main, happily ended by treaties covering the subject.

The fisheries still form the chief industry of Newfoundland, with an output to the annual value of more than $14,000,000. About one-fifth of the 250,000 people are engaged in this industry, although of late years the government has encouraged agriculture, and the copper and iron mines have become of importance. There are large deposits of coal and petroleum, and the extensive forests provide lumber for several paper and pulp mills and for ship-building. Only about five per cent of the 5,000,000 acres of land suitable for agriculture has been improved, and the settlements are confined almost entirely to the coast.

The interior and the western coast of the island are delightful in summer and possess a mild climate in winter. The fogs rarely penetrate inland. Innumerable lakes fringed with woodland dot the interior, and occupy nearly a third of the total area. Deer, lynxes, foxes, beavers, otters, hares, and game birds abound. The island is the home of the sagacious and gentle Newfoundland dog. The people of the island are mostly descended from the English, Scotch, and French fishermen who settled there long ago.

Newfoundland has so far refused to become a part of the Dominion of Canada, and remains a separate colony of Great Britain. It has a governor appointed by Great Britain, but the real power is in the hands of a prime minister and ministry (executive council), together with a parliament, of which the lower house is elected by the people every four years, and the upper house is appointed by the colonial government for life. The 700 miles of bleak Labrador coast is also under the Newfoundland government (*see* Labrador). St. Johns, the capital and only important city (population, about 35,000), is the center of the codfish-drying industry. The island has an area of 42,734 square miles, and a population of about 261,000.

The Land of the HEAD-HUNTERS *and* TREE-DWELLERS

NEW GUINEA. Cannibals and head-hunters, tree-dwellers, and dwellers in pile villages far out in lakes are still found among the savage tribes that make up the greater part of the population of New Guinea, the largest island in the Malay Archipelago and the second largest in the world. Although this great territory is larger than the entire southeastern corner of the United States—Louisiana, Mississippi, Alabama, Georgia, South Carolina, and Florida combined—and although it is a land of boundless possibilities and potential wealth, it has been only partly explored and its development has hardly begun.

"GUN BOYS" OF NEW GUINEA

When white men go hunting in the New Guinea forests they take along natives to carry the rifles and keep them cleaned and loaded.

Along the coast some of the tribes have been partially civilized by missionaries and planters, and by labor on the sugar and rubber plantations; but the savages of the interior are still in the Stone Age of civilization. The men, usually naked save for a loin-cloth, adorn themselves with necklaces and armlets of shell or teeth; and they grease their black frizzly hair so that it sticks out in an awe-inspiring mop. Some paint their cheeks and sloping foreheads with red stripes and stick bits of white shell through the lobes of their thick noses, to increase the ferocity of their appearance. Despite the white man's laws, many of the tribes still cook and eat occasional victims, while others devour their own dead—deeming this the most honorable mode of disposing of the remains.

"HEAD-HUNTERS" NOW GUARDIANS OF THE PEACE

In the center is an English magistrate of the Gulf Division of Papua, British New Guinea, and around him are members of the armed native constabulary, with their rifles and their cartridge belts all filled. These soldiers are from the former "head-hunting" tribe.

On Rossel Island, one of the islands of the Louisiade Archipelago that prolongs the line of New Guinea to the southeast, live a man-eating people second to none for malignity and ferocity. Their favorite mode of killing a victim is to smother him. At the death of every chief they murder one of their own number and eat his corpse. So accomplished are they in the art of smothering that if a Rossel islander wants a pigeon for supper he steals out at dusk, climbs noiselessly to the branch on which the birds are roosting, and smothers one after another without disturbing the rest.

Aversion to water is one of the most marked characteristics of the New Guinea natives, and they usually carry mats to protect them from the rain. Men eat apart from the women, who wear short projecting skirts of grass and do the greater part of the work both indoors and out. The usual weapons are spears, clubs, bow and arrow, shield, and —in some places—the throwing stick.

The many tribes differ considerably in customs, language, and appearance, but nearly all belong to the Papuan race, which some regard as a branch of the Negro race. Besides the Papuans (who get their name from the Malay word for "frizzly") there are a few pigmies in the interior, who average about 4 feet 9 inches in height. On the west coast there are also many Malay settlements.

The rainy island in which these queer people live has an area of more than 300,000 square miles, and is shaped like a monstrous bird. Its greatest length is 1,490 miles; greatest width, 430 miles. If the southeastern point of New Guinea were placed on the tip of the Florida peninsula, the northeastern point would reach almost to Colorado. Yet the estimated population is only 1,000,000—about that of the city of Detroit.

Young rugged mountain ranges towering to 16,000 feet or more form the backbone of the island. The whole interior is cut up by sharp ridges with precipitous gorges between, and the tropical jungle growths are so thick that explorers count two or three miles a day a fair rate of travel. For the most

LIKE THE NESTS OF GIANT BIRDS

Some of the New Guinea natives have such troublesome neighbors that they are obliged to live in houses perched up in trees like that, so arranged that whenever they go "upstairs" they can pull the stairs up after them. The houses are built of interwoven sticks and are covered with long grass. These tree dwellings are common on the New Guinea coast.

For any subject not found in its alphabetical place see information

part travel is restricted to the great rivers—the Fly, Purari, Ottilien, Kaiserin Augusta, and Amberno—which are navigable for hundreds of miles. Along the swampy low-lying coast and in the mud of the river swamps the sago palm grows abundantly, furnishing the staple food of the natives in those regions. Vegetation of unsurpassed luxuriance covers nearly the entire island. The thick forests contain acacias, eucalyptus, cypress, palms of many kinds, and other valuable trees. In plantations under European direction sugar cane, rubber, vanilla beans, coconuts, and sisal hemp are cultivated. Gold mining is one of the chief industries, and there are immense but little-worked deposits of copper. Oil has been found.

In its animals as well as native inhabitants New Guinea resembles Australia, for it lies to the eastward of what is known as the "Wallace line." The island is noted for the number and variety of its birds, which include gorgeous bower birds, parrots, kingfishers, and birds of paradise. Like Australia it has few mammals, and most of these are marsupials resembling the Australian kangaroo. Salamanders, crocodiles, snakes, wild pigs, and mice are numerous; as well as the ostrich-like cassowary, which is so powerful that it can kill a dog with a single blow of its foot.

New Guinea probably was sighted by the Portuguese not later than 1511. In 1793 it was annexed by the Dutch, and in 1884 Germany and Great Britain declared protectorates over the eastern half of the island. Dutch New Guinea, the western half, has been little developed, but considerable portions of the territory formerly belonging to Germany (Kaiser Wilhelm's Land) and of the territory of Papua (British New Guinea) have been brought under cultivation. In 1914 an Australian expeditionary force occupied Kaiser Wilhelm's Land, and this is now ruled by the Commonwealth of Australia (which is but 80 miles distant across the shallow Torres Strait) under a mandate from the League of Nations. (For map, *see* East Indies.)

The "GRANITE STATE'S"
Playgrounds and Workshops

The "Great Stone Face," about which Hawthorne wrote his fascinating story by that name, is clearly to be seen at the left of this picture. From its high place away up on the cliffs bordering Franconia Notch in the White Mountains of New Hampshire, it overlooks a picturesque region of valleys, glens, waterfalls, brooks, and lakes.

NEW HAMPSHIRE. Most people think of New Hampshire, "the granite state," chiefly as a playground, and indeed it does resemble a vast and beautiful park. Practically the whole of the White Mountain region, which occupies the northern half of the state, is devoted chiefly to recreation, either as a result of government reservation or through the enterprise of clubs and societies interested in the great out-of-doors. Here are crisp air, mountains of varying heights for climbers of various strengths, fine hotels, and good motor roads. Bare white summits here and there overtop the cloak of pines, maples, hemlocks, and spruces that cover them to the vegetation line, and imposing valleys open to view from the roads.

Extent.—Greatest length north to south, 178 miles; east to west, 88 miles. Area, 9,341 square miles. Population (1920 census), 443,083.

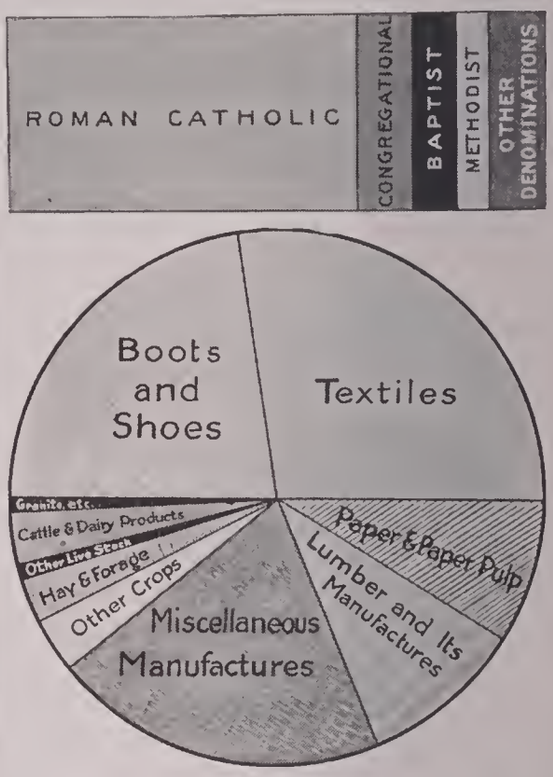
Physical Features.—White Mountains in northern half (highest peak, Mt. Washington, 6,293 feet), and Mt. Monadnock (3,186 feet) in southwest. Connecticut River (western border) and Merrimack River, Lake Winnepesaukee, and smaller lakes near the center. Low country in southeast with 18-mile strip of sea-coast.

Products.—Boots and shoes, textiles, and lumber; fruit (notably apples), poultry, and dairy products; stone, clay products, and mica.

Principal Cities.—Manchester (79,000), Nashua (29,000), Concord (capital, 23,000), Berlin (17,000), Portsmouth and Dover (14,000 each).

The most picturesque spot is perhaps the Franconia Notch, a wooded defile about five miles in length which gaps the western group of the White Mountains about midway in their course. It is dominated by Profile Mountain, whose upper cliffs form the "great stone face" of Nathaniel Hawthorne's story. Mount Washington (6,293 feet) is the highest mountain in New England, and second highest in the whole Appalachian system. For people who find its trails difficult, the top is accessible by means of a cog railway and a good motor road. Mount Monadnock (3,186 feet), familiar to readers of Emerson's poems, is not a part of the White Mountains but is an isolated peak in southeastern New Hampshire.

VERMONT AND NEW HAMPSHIRE



INDUSTRY AND RELIGION IN THE "GRANITE STATE"

Small as it is, New Hampshire is an important factor in the nation's prosperity, for its abundant water-power drives the wheels of many great shoe and textile factories.

The White Mountain tourist season used to be a short one, extending only over the middle of the summer. As late as June you might meet a bear by some woodland spring. Nowadays people are beginning to see the out-of-door possibilities of the long severe winters that used to frighten them away. Winter sports flourish, particularly skiing, and the outing club of Dartmouth College at Hanover (in the foothills, on the Connecticut River) has built a whole chain of mountain cabins for winter use. In the eastern part of the state, opposite Hanover, lies New Hampshire's lake region, where a number of small clear lakes attract summer campers and cottagers. The largest of these, Lake Winnepesaukee, is about 20 miles long and from one to eight miles wide.

But the state has its working as well as its play side. Although in size it ranks only 40th among the United States, with an area of 9,341 square miles, and its population is less than that of the city of Milwaukee, it stands fourth in the manufacture of boots and shoes, and well to the top in the textile industries. It also ranks high in granite-quarrying, in lumbering, and in the making of wood-pulp for paper, for the surface of the state is one-third forest. Abundant water-power is furnished by the rivers which tumble from the mountain regions to the sea. The Connecticut River, which forms the northern as well as the entire western boundary of the state, and the Merrimack, which rises in the White Mountains and drains the lake region, are the chief streams. The Merrimack, owing to its numerous water-power sites, has probably more cotton spindles in operation along its course than any other river in the world.

New Hampshire is also interested to a considerable extent in agriculture, notably truck-farming, fruit, poultry, and dairying, for the bottom lands of the Connecticut and Merrimack, and the southeastern section, have a fertile soil. And although it has the shortest coast-line of the Atlantic States (about 18 miles) and only one port (Portsmouth on the Piscataqua River), New Hampshire supports fisheries for lobster, haddock, etc., as well as considerable shipping. At Portsmouth is located one of the United States navy yards, and it was in this little city that the treaty of peace between Russia and Japan was signed in 1905.

Its industrial activity has led to the concentration of New Hampshire's population in about nine small cities. The largest of these is Manchester in the southern part of the state on the Merrimack and Piscataquog rivers. It derives an immense amount of water-power from the Merrimack, by means of a system of canals, for its many cotton and woolen mills, boot and shoe factories, and other large industries. Nashua, about 15 miles south of Manchester on the Nashua River, also has large cotton mills and a variety

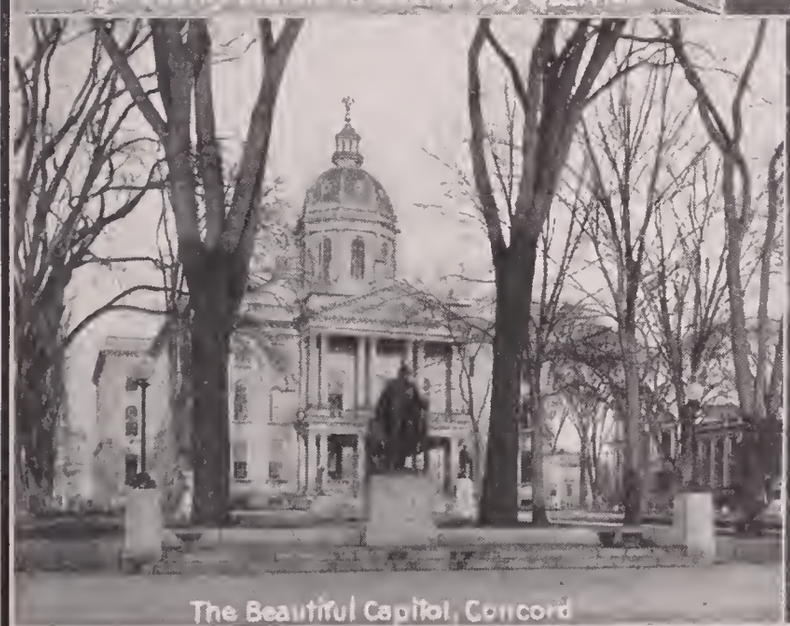
CONTRASTS OF NEW AND OLD IN NEW HAMPSHIRE

Many Great Textile Mills Along the Merrimack

High Quality Granite is Quarried

Ranks High in Shoe Making

Fine Fruit from the Fertile Bottom Lands


The Beautiful Capitol, Concord

Historic Dartmouth College, Hanover

No New England state shows better than New Hampshire the contrast between the twentieth century, with its busy factories, and bygone generations whose memory is recalled by quiet tree-shaded walks among old historic scenes.

contained in the Easy Reference Fact-Index at the end of this work

of other manufactures, and is the distributing center for an extensive agricultural district. Concord, the capital, on the Merrimack, is likewise a manufacturing center and in its neighborhood are extensive quarries of fine-grained white granite. It is the seat of St. Paul's School, which, with Phillips Academy at Exeter, is among the most famous boys' schools in the United States. Of the institutions of higher rank in New Hampshire, besides Dartmouth, there are normal schools at Keene and Plymouth, the New Hampshire College of Agriculture and Mechanic Arts at Durham, and St. Anselm's College (Roman Catholic) for men at Manchester.

The early history of New Hampshire is a story of isolated settlements for fishing and fur-trading, woven into a bewildering maze of English land grants to absentee companies or landlords. The first settlements were at the mouth of the Piscataqua, in 1623. John Mason and Sir Ferdinando Gorges were the most prominent grantees of the region between the Merrimack and Piscataqua rivers, and it was Mason who conferred upon it the name of New Hampshire, after his own county of Hampshire in England. Both of these grantees were staunch Church of England men and friends of King James I. There were long jurisdictional disputes with Massachusetts arising in part out of conflicting grants, and for over 70 years New Hampshire was either a part of Massachusetts or under the same governor appointed by the crown. The colony became a separate province in 1741.

The boundary dispute was settled in 1740, very much to New Hampshire's advantage. The decision established as the charter line "three miles north of the Merrimack," the present boundary paralleling the river from its mouth to its most southern point, instead of to its source, as Massachusetts claimed. There were also long disputes with New York due to conflicting claims to what is now Vermont. These continued until the admission of Vermont as a separate state, in 1791, established the Connecticut River as New Hampshire's western boundary.

New Hampshire was the ninth state to ratify the Federal constitution (June 21, 1788), thus completing the number needed to start the new government.

LOGGING IN THE WHITE MOUNTAINS

In the winter time, when the White Mountains are white with snow, the loggers set to work hauling out the big trees and the many lumber camps are busy getting material ready for next year's market.

New Haven, Conn. The "City of Elms," famed for 200 years as the seat of Yale University, is situated at the head of New Haven Bay, an inlet of Long Island Sound 72 miles northeast of New York City. New Haven is Connecticut's first city in regard to population and manufactures, and one of the great educational centers of the United States.

A line of rugged hills, ending in two 360- and 400-foot spurs called East Rock and West Rock, rises in the background and looks down upon the city built on a level sandy plain. In the central older part it is laid out in squares around the 16-acre public Green (once a religious and social center). To the north and east of the Green rise the many fine buildings of Yale University. New Haven has many handsome public buildings, parks, gardens, and broad shaded streets.

With its harbor, and main line and branches of the New York, New Haven, and Hartford Railroad, New Haven has good shipping facilities and is a distributing point for the coal, cement, lumber, and fertilizer brought there by water. The wheels of industry hum in its manufactures of firearms and ammunition, hardware, clocks, rubber goods, and foundry and machine-shop products. The Winchester Repeating Arms and the New Haven Clock Company are two of the important factories, and the large machine shops and general offices of the New York, New Haven, and Hartford are located here.

New Haven was called by its Indian name Quinnipiac (Long River Place) in 1638 when Theophilus Eaton, John Davenport, and a small company of Puritans settled there; but two years later it received its present name (from Newhaven, England). It remained a separate colony from Connecticut until 1662. From 1701 to 1873 New Haven was joint capital with Hartford. In 1716 Yale College was moved here from Saybrook. New Haven is the burial place of Noah Webster, Samuel Finley Breese Morse, Lyman Beecher, Eli Whitney, Roger Sherman, and other famous men. Up on West Rock is Judges' Cave, the famous hiding place in 1661 for the regicides Goffe and Whalley. Large foreign groups today far outnumber the descendants of the old New England families. Population, about 165,000.

NEW JERSEY, *the* "GARDEN STATE"

Extent.—North to south, 166 miles; east to west, average, 50 miles. Area, 8,224 square miles. Population (1920 census), 3,155,900.
Physical Features.—Kittatinny Mountains in the northwest (highest point, about 1,800 feet), the Highlands, forested hills, crossing the state from north to southwest and giving way to a rolling piedmont plain to the south; coastal plain covering the southern half of the state. Principal rivers: Delaware, forming the western boundary, and Hudson on the east; Hackensack, Passaic, Raritan, Mullica, and Great Egg flowing into Atlantic Ocean, and Maurice into Delaware Bay.
Products.—Smelted copper, silk and woolen goods, refined oil, foundry and machine-shop products, meat-packing products, chemical, electrical supplies, pottery; zinc, cement, sand and gravel, iron; potatoes, hay, corn, wheat, oats, fruit; fish.
Principal Cities.—Newark (415,000), Jersey City (300,000), Paterson, Trenton (capital), and Camden (over 100,000); Elizabeth, Bayonne, Hoboken, Passaic, Atlantic City, and East Orange (over 50,000).

NEW JERSEY. "Like a cider barrel tapped at both ends" was Benjamin Franklin's description of New Jersey; for in his time the growth of Philadelphia and New York as great commercial centers tended to attract many of New Jersey's inhabitants to those cities. Today, although New York and Philadelphia still "tap" New Jersey for its luscious fruits and fresh vegetables, which pour into those cities in great quantities from early spring to late autumn, the situation is reversed with regard to its people. Every afternoon tides of New Yorkers and Philadelphians, their day's work done, pour by train and ferry into New Jersey; for the population of these giant cities has overflowed their boundaries, and Hoboken, Jersey City, Newark, and Elizabeth have long been residential suburbs of New York, while New Jersey's cities farther south house thousands of Philadelphia's busy workers.

There are only three states in the Union smaller than New Jersey; but no state produces a greater variety of manufactured articles, or, in proportion to its size, a greater number of agricultural products. Situated in the midst of the most thickly populated region of the Union, its unexcelled market advantages make truck gardening, dairying, and poultry raising great industries; while, with Pennsylvania coal near at hand, and excellent transportation furnished by rivers, railroads, and the great New York harbor, New Jersey is bound to occupy a favored position as regards manufacture.

There are five distinctly marked sections in New Jersey, running in almost parallel strips across the state from northeast to southwest. Paralleling the Delaware River along the northwestern border are the rocky and heavily wooded Kittatinny Mountains, a continuation of the Pennsylvania Appalachians rising to 1,800 feet—a favorite resort for visitors in summer. South of these mountains lies a wide valley section with rolling country, pleasing landscapes, and beautiful farming lands famous for their garden crops, fruits, and poultry. The third section, extending also from northeast to southwest, is the Highlands, a hilly or mountainous region of limited agriculture and population, but superb natural scenery. Still farther south is a piedmont plain, level and gently rolling, known for its large crops of "garden truck"—potatoes, tomatoes, fruit, corn, and the like. At the extreme south lies the fifth section, a coastal plain covering half the entire state. Much of this region is undeveloped; for here lie The Pines, a wooded area of considerable extent, and large areas of sandy soils. But market gardening, fruit growing, cranberry cultivation, and poultry raising are increasing, and skilful handling has produced crops greater even than those grown on the naturally rich lands of other states. The general altitude of the state is so low that if the land were to sink 100 feet, nearly half of it would be under water; only the northern third and a group of islands in the middle part and another in the southeast would remain above sea-level.

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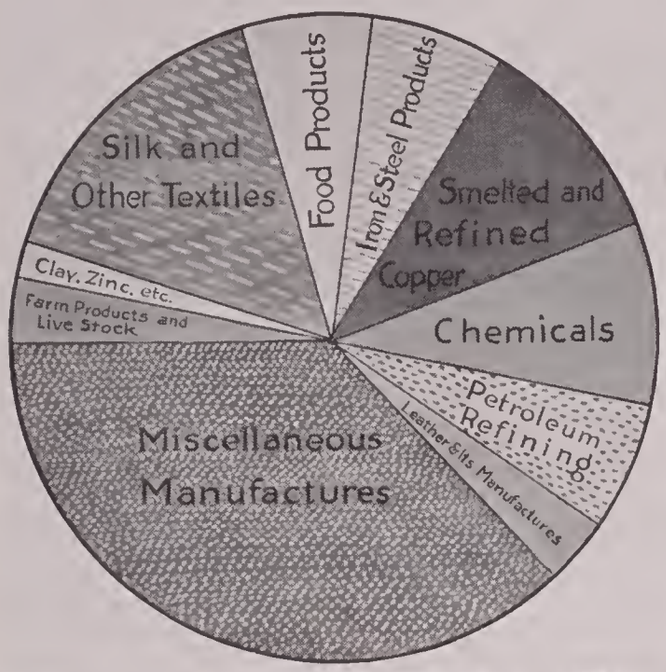
PRODUCTS OF FACTORY AND WORKSHOP

So varied are the manufactures of New Jersey that the largest segment of this products chart is taken up by those classed as "miscellaneous." Silk and other textiles form the next largest group. The religious divisions are shown below.



The Jersey coast is famous throughout the world for its summer resorts. From Sandy Hook to Cape May, a distance of 125 miles, is one of the chief summer playgrounds of the country, owing to its pleasing climate, splendid level bathing beaches, and the many inlets and bays which afford ideal conditions for sailing and yachting. Some 20 miles south of "the Hook," so familiar as a landmark to vessels inward bound for New York, is Long Branch, situated on a bluff and broad plateau, with many wide avenues and immense hotels. Not far away is Asbury Park, with its fine beach, good hotels, pavilions, and parks; and Ocean Grove, which contains one of the largest auditoriums in the country, and is separated from Asbury Park by Wesley Lake. To the south is the famous Atlantic City (*see* Atlantic City, N.J.); while at the extreme tip of the state lies Cape May, a fashionable watering place with a magnificent beach. Many smaller resorts dot the coast, almost every mile of which has been more or less developed.

Unsurpassed in Variety of Manufactures

New Jersey is one of the most important manufacturing states in the Union, holding a high place in the total value of manufactured articles, and surpassing all other states in variety. A large proportion of all the silk produced in America is manufactured in New Jersey, and it also ranks among the foremost states in the smelting and refining of copper, in oil refining, and in the manufacture of linoleum, oilcloth, and sewing machines. Newark is said to produce a greater variety of goods than any other city in the United States, and Jersey City also has hundreds of miscellaneous industries. Paterson is famous for silks, Passaic for woolen and worsted goods, Trenton for pottery of all kinds, Camden for shipbuilding, Elizabeth for sewing machines, and Bayonne for refining oil and coal shipping. So great is the preponderance of manufacturing that more than 80 per cent of New Jersey's population lives in its cities. The region about New York, although it contains several municipalities, seems almost like one continuous city.

New Jersey's mineral resources must also not be overlooked; for although the state is 45th in size, it ranks about 15th in the value of its mineral products. This wealth consists chiefly of pottery and other clays in every variety which the United States produces. They are dug in all counties but one. New Jersey

BUSY MANUFACTURES AND OLD TRADITIONS

Little New Jersey plays a big part in the nation's life because it is a vast workhouse, with many bustling cities almost "touching elbows" with each other. Among its leading products are silk, refined copper, linoleum, pottery, sewing machines, dye-stuffs, and electrical supplies. Flower-raising is a pleasing variety in its industry, while its traditions are reflected in the charm of its famous university and the quiet dignity of its Capitol.

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HOBOKEN'S WATER FRONT ON THE HUDSON

Here are some of the docks at Hoboken, with a typical assortment of steamers, big and little, receiving and discharging cargo. The docks in the foreground were taken over from German shipping interests when the United States entered the World War, and saw the embarkation of thousands of American soldiers on the way to Europe. New York City is visible in the background.

has zinc mines which produce ore of a high grade, and much ore from other states also is smelted. Iron is also mined, stone is quarried, and several million dollars' worth of sand and gravel are obtained yearly. In its greensand marl deposits, which contain glauconite (a silicate of iron and potassium), the state possesses a potential source of potash of incalculable importance.

Nearly every kind of fruit and vegetable finds a congenial soil and temperature in some part of New Jersey. Peaches and apples are cultivated extensively. The southern counties produce large quantities of strawberries, raspberries, and blackberries, and an annual yield of cranberries that is one-third of the total produced in the United States. Grapes are also much grown in the south, and plums, cherries, and currants are common to all sections. Jersey sweet potatoes, admitted to be the "sweetest of the sweet," are grown in large quantities, and the state ranks second in the growing of asparagus. Great poultry farms are found in the north, and dairying is important in almost every part of the state.

The growing of flowers for the cut-flower trade is another industry that has grown to immense proportions, the value of roses alone reaching annually into hundreds of thousands of dollars.

With its long stretch of sea-coast, and the Delaware and Hudson rivers, New Jersey is well adapted to the fishing industry. Along the coast and in Delaware Bay are about 15,000 acres of productive oyster beds, and vast quantities of clams and fish of many kinds are sent each year to the nearby markets.

A WHOLE QUACKING ACRE IN NEW JERSEY

If you could "hear" this picture as well as see it, you would simply have to cover up your ears. For you know how ducks—there must be an acre of them here—quack when they get sight of water. Duck raising is one of the most profitable side lines of the New Jersey farms and truck gardens.

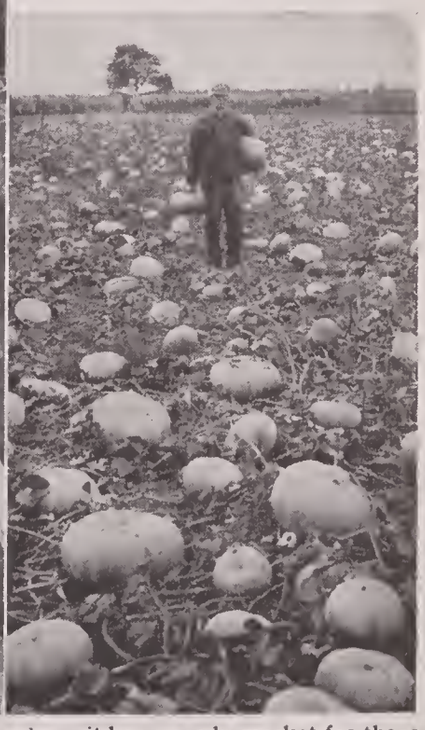
A PART OF THE 125 MILES OF "SWIMMING HOLE"

There are something like 125 miles of such scenes as this from Sandy Hook to Cape May, all through "the good old summer time." The Jersey coast is famous the world over for its summer resorts with their fine, wide beaches everywhere, and every now and then inlets and bays for pleasure boats. This picture was taken at Cape May.

New Jersey was first settled by the Dutch, who occupied the eastern part of the state between 1614 and 1621. In 1635 Sweden established a settlement in the southern part and threatened to become a rival of Holland, but its colony was subdued in 1655. In 1664 England laid claim to the whole region about the mouth of the Hudson and New Jersey was granted to Lord Berkeley and Sir George Carteret — the name "New Jersey" being given in honor of Carteret, who had been governor of the island of Jersey in Europe.

During the Revolution New Jersey was the scene of some of the most dramatic events of the war—the retreat of Washington through its territory, the capture of the British force at Trenton, and the affair at Princeton. In the constitutional convention New Jersey hesitated to strengthen the Union out of fear of the larger states, and put forward what was called the "New Jersey Plan," which proposed equal representation of the states in a single legislative body. This plan was partly adopted in the make-up of the Senate.

"GARDEN STATE" RICHES



New Jersey is famous for its fruit and vegetables. With all the great cities situated near its gardens, it has a ready market for these products. At the left is a potato field where workmen are collecting the bountiful crop. In the middle we see two boys with more peaches than they could possibly eat. At the right is a field of pumpkins.

NEWMAN, CARDINAL JOHN HENRY (1801–1890). When all else that Newman did and wrote has been for the most part forgotten, his name will still be kept alive by his well-known hymn:

Lead, Kindly Light, amid the encircling gloom,
Lead Thou me on!
The night is dark, and I am far from home;
Lead Thou me on!
Keep Thou my feet; I do not ask to see
The distant scene,—one step enough for me.

These beautiful lines have found their way into almost every heart and hymn-book. Newman composed them in 1833, while on shipboard returning to England from a voyage to the Mediterranean, before the religious questionings had arisen which led him from the Church of England to the Church of Rome. During his long life his work was largely a passionate expression in masterly prose of intellectual struggle and spiritual quest.

Two years after taking his degree at Trinity College, Oxford, he obtained a fellowship at Oriel, "the center of Oxford intellectualism." Always of a dreamy religious temperament, he became a clergyman of the Church of England as well as an Oxford tutor. He became a leading spirit in the famous "Oxford movement," a High Church reaction which manifested itself in a series of 'Tracts for the Times', of which he was the chief author. His romantic vision of the medieval church restored in its power and grandeur gradually led this simple sincere ascetic, with grave kind eyes and a thoughtful smile, back to the Roman Catholic church, which he called "a home after many storms." He was ordained a priest at Rome in 1845, and was appointed a cardinal in 1879. He died at Birmingham on Aug. 11, 1890.

It was in his many sermons, lectures, and writings that Newman became one of the great religious forces of his day. The spiritual fervor, the searching subtle intellect, and the charm of his personality were supplemented by a fine prose style which for ease, clearness, and beauty has seldom been surpassed.

Among Newman's many important writings are his 'Apologia pro Vita Sua' (1864); 'Verses on Various Occasions' (1868) which includes the beautiful 'Dream of Gerontius'; 'An Essay in Aid of a Grammar of Assent' (1870); and 'Letter to the Duke of Norfolk' (1875).

NEW MEXICO-WONDERLAND *of* RUGGED BEAUTY

NEW MEXICO. The strange beauty and charm of the ancient land to which its white inhabitants have given the name of New Mexico have been summed by the Western novelist Zane Gray, who knows it well. He speaks with enthusiasm of the "red rocks, the alkali flats like snow, the sand dunes so graceful and curved, the long cedar slopes, speckled green and gray, leading up to the bold peaks; the vast black belts of timber; the Navajo facing the sunrise with his silent prayer, the Hopi in his alfalfa fields, or the Apache along the historic Apache trail; the coyote sneaking through the arroyos; the lonely cliff dwellings with their monuments of a vanished race; the endless slopes of sage, green and gray, and purple on the heights; the smell of cedar smoke, like burning leaves in autumn; the smell of the desert, dry and clean and somehow new; the tangy odor of the great plateaus of cedar and juniper when your nostrils seem glued as with pitch; the sweet fragrance of the pine forests, and the indescribable and exhilarating perfume of the purple sage."

Extent.—North to south, 400 miles; east to west, 358 miles. Area, 122,634 square miles. Population (1920 census), 360,350.
Physical Features.—A vast table-land (average altitude 5,700 feet) sloping downward toward the Staked Plains in the southeastern corner, thickly ridged by many ranges of the Rocky Mountain system (highest point, Cerro Blanco, 14,269 feet), and isolated sierras, mesas, and buttes. Principal rivers: Rio Grande and Pecos, draining the greater portion; Canadian River in northeast.
Products.—Cattle, sheep, and wool; alfalfa; copper, coal, zinc, and silver; lumber.
Chief Cities.—Albuquerque (16,000), Las Vegas, Roswell, Santa Fe (capital), and Raton.

The state is a vast table-land broken by many mountain ranges. Only in the Staked Plains region is it possible to get out of sight of the mountains. The Rocky Mountains enter the state at the north and extend southeast for about 120 miles, as far as Santa Fe, in an unbroken chain of lofty peaks. The characteristic feature is the mesas, vast flat-topped hills that rise straight up from the surrounding country. Lava plateaus and other evidences of volcanic action occur in the state. The highest point is Cerro Blanco (14,269 feet) in the south central part.

FAMILY LIFE IN A NEW MEXICO "SKYSCRAPER"

These people—Walpi Indians of New Mexico—have quite a few such lofty strongholds. This one is 600 feet high, and is approached by the steep path you see here. Of course there is no need for precaution nowadays, but the homes and habits of these people were established centuries and centuries before they came under the control of Uncle Sam's government, so they still live on these high cliffs and climb the long stairways. An interesting thing about the Walpis is that those women and not that man are the rulers of their respective households. When a woman marries, her husband takes her name. Should she become tired of him, she simply sets his saddle outside the door, and he understands what he is expected to do.

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"ELEPHANT BUTTE" DAM IN THE RIO GRANDE VALLEY

When Uncle Sam had finished this magnificent piece of irrigation engineering, he had done a tremendous thing toward the transformation of the desert. This dam stores enough water to cover 2,500,000 acres a foot deep.

Among the most wonderful of the mesas are the superb Enchanted Mesa and its neighbor Acoma, a "dizzy air island" of 70 acres upheld by overhanging cliffs 375 feet above the plain. On the flat summit of Acoma perches an ancient Indian village—old at the time of the Spanish conquest—which has been called the "Quéres Gibraltar" and the "Quebec of the Southwest," with the qualification that either Gibraltar or Quebec would be more easily stormed than Acoma, the like of which for stern inaccessibility as well as for beauty and grandeur exists nowhere in the world. Its patient founders had to carry up from the plains on their backs every bit of adobe mud and stone used in building their three-story houses and their church, with its walls 60 feet high and 10 feet thick. In the church (built, of course, after the conquest) are timbers 14 inches square and 40 feet long, brought by human muscle alone from the mountains 20 miles away. Its 800 industrious inhabitants still descend periodically from the rock to till their fields and graze their flocks and herds on lands in the valley now secured to them by United States grant. The great plains east of the Rockies cover about two-fifths of the entire state. The immense arid table-land called the Staked Plains ("Llano Estacado") is in the southeastern corner. The basin of the extinct Lake Otero in the south central part is remarkable for its white sands where dwell white reptiles and insects, peculiarly interesting examples of protective coloring.

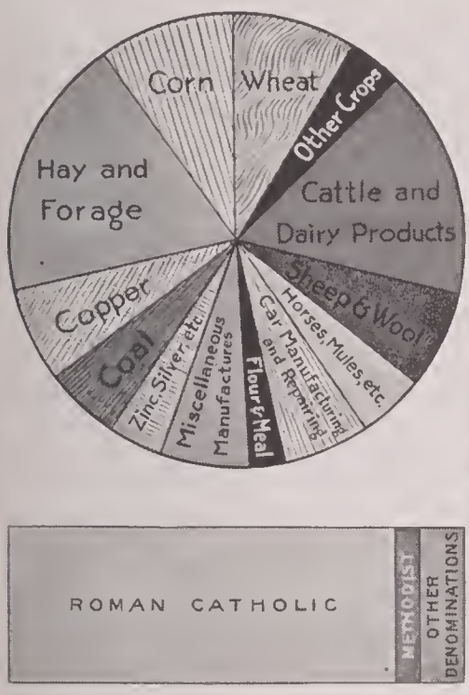
The valleys and flood plains of the streams are grassy and fertile and capable, especially when irrigated, of furnishing abundant pasture for flocks and herds. Salt marshes or "alkali flats," which furnish the salt needed by the cattle ranges, occur in various places, especially in the west center and near the Rio Grande on the southern border. The vast arid plateau of the northwest, more than 6,000 feet high, is dotted with sage-brush and greasewood.

Both the Rio Grande and the Pecos rivers are mountain streams at their sources. When the snows of the Rocky Mountains begin to melt, the Rio Grande floods the lowlands and covers them with a rich deposit of silt. During the dry season many of the smaller rivers disappear beneath the surface, leaving dry channels called *arroyos*.

The picturesque flowering yuccas abound everywhere. Pinyon and cedar trees are abundant in the foothills, and mesquite and the saguaro, a giant cactus, in the south. The native animals are not numerous, but include bears, deer, mountain lions, wildcats, antelopes, and coyotes. Rattlesnakes, the Gila monster, and the tarantula are common only in certain places and at certain times.

The climate, with its hot yet never oppressive summer days and always cool nights, is peculiarly healthful because of the low humidity, high altitude, and southern latitude. Plants dry up and dead bodies mummify rather than decay; wood is practically ever-

NEW MEXICO—ITS SURFACE, PRODUCTS, AND RELIGIONS



In the vast rugged rectangle covered by New Mexico, 98 Rhode Islands could be packed, for this is the fourth largest state in the Union.

lasting and one can cure meat in the open air without salt. Except in the northwest there is a so-called wet season of about six weeks beginning early in July.

New Mexico is first of all a grazing state. The first merino sheep came into the province with the early Spanish colonists, and their descendants graze there today. The days of the "sheep kings," who numbered their sheep by the hundred thousand, are over; and cattle are now more numerous than sheep. Yet New Mexico is still one of the leading wool-growing states.

Alfalfa is the leading farm crop. A wide range of grains, fruits, and vegetables are grown most successfully by irrigation which was practiced by the Pueblo Indians for ages before the coming of white men. A large area of hitherto unusable land is made fit for agriculture by the completion of a number of government and private irrigation projects, especially the huge dam constructed by the government at Elephant Butte in the Rio Grande valley. This submerges 40,000 acres, stores more than 2,500,000 acre-feet of water, and controls the irrigation of 183,000 acres of very fertile land (part in Texas). Along the Pecos valley, especially between Roswell and Carlsbad, where the government has reclaimed nearly 25,000

ALONG ONE OF NEW MEXICO'S MANY IRRIGATION CANALS

The canals of the irrigation systems add materially to the attractions of the landscape, as you see, besides doing the very useful service of carrying water for the thirsty land. With their cement-lined walls, they look as neat as the curbing of a fine city street. This picture shows a section of the main canal of the irrigation system by which Uncle Sam has reclaimed nearly 25,000 acres of New Mexico land between Roswell and Carlsbad.

THREE CHIEF SOURCES OF NEW MEXICO'S WEALTH

At the upper left is a heavy yield of alfalfa, a forage crop admirably suited to New Mexico. The upper right-hand picture shows feeding-time on a sheep ranch—another of the industries which thrive in the state. Below is one of the many establishments supported by the mineral wealth of the state—a concentrator, where much of the waste in ore is eliminated.

acres, and near the southern border of the state west of the Rio Grande, water from artesian wells is extensively used in irrigation.

The mineral resources are important. Silver City, in the southwest, is the center of the copper, lead, silver, and gold mining region. Coal is mined in the north. The turquoise mines were worked in Spanish times, possibly earlier. Garnets, opals, and chalcedony are found; soda, salt, potash, mica, marble, tungsten, and vanadium are among the other minerals.

The mountain ranges, especially in the north, are forested with valuable trees, pine being the most important. The Federal government has reserved several forest tracts. In the main, New Mexico exports raw materials and imports manufactured articles. Lumber and the handwork of the Indians are among the few articles manufactured which go outside the state.

Santa Fe, the capital, founded by Juan de Oñate in 1605, is the first permanent Spanish settlement in the Southwest, the second oldest white settlement in the United States, and perhaps the most interesting city in the Southwest. Separated from Mexico by hundreds of miles of desert, it was an outpost of Spanish civilization. Set in the middle of a broad valley, with the sunset of the Sangre de Cristo Mountains flaming in the west, Santa Fe was the vision which gave new life to many a worn-out, hopeless traveler. The famous old Santa Fe Trail, whose "milestones are the bones of pioneers," was an 800-mile journey from Santa Fe to the American frontier, at what is now Kansas City. The first caravan of pack animals that traversed it left Kaskaskia, Ill., in 1804. In the following years caravans and dust-covered prairie schooners, accompanied by the sunburned and weather-beaten emigrants and their families, pushed steadily along the trail despite the privations and dangers of the desert with its savages. In 1880 the Atchison, Topeka & Santa Fe Railroad made the old trail an iron road. Santa Fe contains many fine old historic buildings, a modern Roman Catholic cathedral, the museum of New Mexico, the state capitol, and various other state buildings. It is the seat of the School of American Research, of a government Indian school, and various other educational institutions.

Albuquerque, the largest city, was founded by the Spaniards in 1706. It is the seat of the University of New Mexico, a government school for Indians, the Harvey Indian museum, several large sanatoriums, and a number of the state's manufacturing establishments. Las Vegas (which is practically two towns, an

old Mexican settlement and a modern city) is an important wool market, the seat of the New Mexico Normal University, a manufacturing center, and a health resort. Roswell, the seat of the New Mexico Military Institute, is the center of a rich grazing and farming country and has a number of flour mills. Raton is the commercial and industrial center of a large coal-mining, grazing, and farming region. At Socorro is the state School of Mines; near Las Cruces is the College of Agriculture and Mechanic Arts; the Spanish-American Normal School is at El Rito, and the Normal School at Silver City.

There is a large Mexican element in the population of the state, and about 20,000 Indians.

New Mexico was inhabited for untold generations before the discovery of America, as the ancient pueblo ruins and cliff dwellings testify. Because of the great archaeologic importance of the many ruins and remains of ancient peoples scattered through this region, the Federal government has set apart several of them as national monuments. Among these are the prehistoric pueblo or village ruins of Tabira (the so-called Gran Quivira), El Morro, the Inscription Rock, covered with Spanish records going back to 1606, and the Gila Cliff Dwellings.

THE STATE CAPITOL AT SANTA FE

We are looking up at the dome of the state Capitol at Santa Fe. It is an attractive building of brick and stone, set in beautiful surroundings.

The peaceful agricultural Pueblos (*see* Pueblo Indians), who dwelt here when the Spaniards came and who needed no lessons in patience, industry, and thrift from white men, still retain their picturesque costumes, their remarkable communal village organization, and their ancient tribal customs. Their one-time troublesome neighbors the Navajos, settled on a reservation which extends from Arizona into New Mexico, till the soil, and practice many primitive industries, notably the weaving of the famous Navajo blankets. The even more terrible kinsmen of the Navajos, the fierce Apaches, to escape whom the Pueblos made their dwellings on the inaccessible rocks and who were so long the scourge of the Southwest, have also been learning the ways of peace since they were finally subdued by Gen. Nelson A. Miles in 1886. Two Apache tribes, the Jicarillas and Mescaleros, are settled on reservations in New Mexico.

Early in the 16th century the Spaniards were attracted to the land north of Mexico by tales of cities of fabulous wealth beyond the desert. The Franciscan friar Marcos de Niza in 1539 was the first white man who made the journey across what is now the United States border by the land route, up the Sonora valley and down the San Pedro to the Gila. Coronado followed him the next year, but failed to find the marvelous cities of which he was in quest. The first colonizer of New Mexico was a wealthy Mexican, Juan de Oñate, who with 400 colonists took possession of New Mexico in 1598, and in 1606 established the seat of government of the province at Santa Fe. The Pueblo Indians long resisted Spanish rule, and in 1680 succeeded in killing or expelling all the Spaniards. Twelve years later the authority of the Mexican viceroy was reëstablished. In 1846, during the Mexican War, Gen. Stephen W. Kearny took possession of the province for the United States. New Mexico (then including Arizona) was formally ceded to the United States by the treaty of Guadalupe Hidalgo in 1848, and in 1851 the Territory of New Mexico was organized. The present southern boundary was established by the Gadsden Purchase in 1853. In 1863 the Territory of Arizona was carved off, and in 1865 New Mexico was reduced to its present limits by the annexation of a northern strip to Colorado. During the Civil War Santa Fe, in 1862, was occupied successively by Confederate and Federal forces. In 1863, after the Confederates had been forced back into Texas, the Union troops compelled the Navajos to accept life within a reservation. The Apaches proved more troublesome, and broke out in many raids. The last was in 1885-86, when the capture of their chief, Geronimo, ended their war-making. New Mexico was admitted to the Union as a state in 1912, after many unsuccessful previous efforts.

The QUEEN CITY *of the* SOUTH

NEW ORLEANS, LA. The gateway to the Mississippi Valley with Latin-America just across the Gulf of Mexico and the markets of Asia accessible through the Panama Canal, New Orleans is destined to be one of the great shipping centers of the world. By way of the Panama Canal, it is about 600 miles nearer than New York to every port on the west coast of South America, and on the east coast only Brazil, Argentina, and Venezuela are nearer to New York than to the "Queen City of the Gulf." In many respects New Orleans is more convenient for commerce even with these three countries, because it is so much nearer to the great industrial and producing centers of the United States. It is not so near as New York to Europe, but it is 585 miles nearer to Yokohama, Hongkong, Manila, and Singapore. Hence, when the second largest shipping company of Japan established steamer connections with the United States, it made New Orleans its terminal.

Built originally along a great bend of the Mississippi, 107 miles above its mouth, with streets that curved to follow the river, New Orleans was given the name of "the Crescent City." But it long ago outgrew this shape, as it gradually made its way back to Lake Borgne and Lake Pontchartrain. It has one of the safest harbors in the world, and will soon have a double outlet to the sea. The longer route is down the Mississippi; the other, only about half as long, is being established by the building of the Inner Harbor or Industrial Canal (begun in 1918) extending from the river through the city to Lake Pontchartrain. This new waterway ranks with the half-dozen greatest world canals, for it has a depth of water equaled only by the Panama, Suez, and Kiel canals. It is not only a great advantage to shipping, but it gives the city a site for vast new industrial enterprises.

About 60 lines of steamships connect New Orleans with other ports, and a dozen railroads carry goods to and fro. A municipal belt railroad connects all terminals, and spur tracks run alongside the docks and warehouses. Several new many-storied reinforced concrete warehouses, with more than a million and a half square feet of floor space, are an important addition to the storage and handling facilities. The wharves, belt railway, and warehouses, being publicly owned, give shippers the lowest freight rates and most efficient service. Several great dry-docks, with facilities for repairing, caulking, and painting vessels, and adjacent iron-working plants, equipped to handle all metal work in connection with the repair of steel vessels, are at the service of the steamship companies.

New Orleans is the greatest market in the world for cotton, molasses, rice, and burlaps, and the largest in the South for sugar and coffee. It ships great

ON THE BUSY WHARVES OF NEW ORLEANS

You see how perfectly everything is arranged here. The ships come right up alongside the docks and are unloaded directly into the great steel warehouses. Tracks run right along the docks to carry freight away from these warehouses or bring it to them for transfer to outgoing vessels. New Orleans has 41 miles of harbor frontage, about nine miles of which is equipped with such facilities as these.

For any subject not found in its alphabetical place see information

quantities of sulphur, lumber, salt, and cottonseed oil—all produced in Louisiana—and Southern and Mexican wool is shipped through in quantities to Northern mills. Vast grain warehouses testify to the extent of its export commerce in wheat, corn, and other cereals. A constant stream of products too numerous to mention constantly flows in from foreign ports, including shipload upon shipload of bananas from Central American ports.

New Orleans is also one of the greatest manufacturing cities in the South. The largest mahogany plant in the world is situated there, and the largest sugar refinery is just outside the city. It is fast becoming the shipbuilding center of the South, with three shipyards within the city and three others in its immediate vicinity. The recent discovery of vast pockets of natural gas within 60 miles is expected to cut the cost of production by giving cheap and convenient fuel. This, coupled with the city's fine transportation facilities, is a boon to industry.

A BUSINESS STREET AND A STREET OF HOMES

The upper picture shows the great stores and office buildings along Canal Street, the axis of New Orleans. This street runs north and south and divides the city sharply into two parts—the French quarter to the east, and the modern portion to the west. You can judge the street's tremendous width by noticing that even four car tracks and two automobile parking rows do not fill it. The lower view shows a charming residence street.

New Orleans proper lies on the east side of the river; but both banks are lined with wharves and warehouses, and in the season that follows the harvests of the West and South these are filled with the raw staples of those regions. Mile after mile of great "levees" or dikes bar the rising waters of the Mississippi from the city, which is built on ground 2 to 12 feet below the river's level. Parallel to these levees on both sides of the river are the markets and freight-houses. The wide passageways are ever congested with huge trucks and wagons that ply between the depots and docks. In the city proper the business section flanks the markets, and tall buildings lift their shafts to the sky. Northward and southward lie factories. The modern residence district, lying farther back from the river-front, away from the clinging smoke of the factories, denotes the prosperity of the city. The pretentious dwellings, set in spacious lawns of emerald green, the broad palm-bordered streets, the extensive, well-kept parks, contrast strangely with the old New Orleans, the city of

THE LARGEST COTTON WAREHOUSE IN THE WORLD

New Orleans shares with Galveston the honor of being the greatest of cotton shipping ports, and this, the largest of all cotton warehouses, was built to take care of this immense traffic.

American-born French and Spanish (Creoles), who still cling to the speech and customs of their ancestors.

This old French quarter is in reality a city in itself, little touched by the tide of industry that has created the modern metropolis. It lies hemmed in by the smoking factories, the rambling warehouses, and busy section of the city of today. The narrow flagstone-paved streets run between crowded rows of quaint old dwellings erected more than a century ago, and patterned after the houses of southern France, Spain, and Italy. Heavy iron-bound doors open abruptly on the uneven sidewalks, and through clinging vines of roses and ivy that clamber over the great gates one catches glimpses of fine old courtyards with time-scarred fountains and statues, crumbling pavements, and a riot of tropical greenery. Hanging over the courtyards are pretty balconies with railings of beautifully wrought iron. Within these ancient mansions dwell in quiet dignity the old Creole families, whose histories date back to the earlier days of New Orleans. They watch with patient resignation the inroads that American progress makes on their picturesque habitations. Even the twisted streets, named for old French and Spanish governors, recall the romantic days of the 18th century. The old market place is still a reminder of a vanished past; and of an early morning, when crowded with people haggling over their wares, it presents a pleasing picture. Ebony-skinned negroes bear round baskets atop of their kinky heads, easily balancing their loads of fruits and vegetables as they make their way across the uneven stones. Bright-hued sunbonnets, hiding the faces of dusky wearers, add a wealth of color to the scene. The beauty and romance of the whole Latin quarter have made it the Mecca of travelers and the theme of stories, and the tourist as well as the old French and Spanish families truly sorrows as the wheels of commerce relentlessly crush down the old and fascinating, to place in its stead the modern and utilitarian. The old walls that formerly marked the city's boundaries are now wide tree-lined avenues; and the old "commons" or *Place d' Armes*, with which was associated nearly every important historic event of Louisiana, is now a neatly laid-out stretch of flower-beds, white shell walks, and shaven shrubbery, known as Jackson Square. But this city, in which history, poetry, and romance are so indissolubly united, still retains something of its old-time charm. The yearly Mardi Gras carnival, a heritage of the Latin Old World to its faithful children of the New, long did much to keep the old-fashioned spirit alive. It was a season looked forward to by young and old

New Orleans also has the largest mahogany distributing plant in the world. The mahogany logs come from Central and South America, and the saws of this mill cut them up into the lumber which you see stacked in those piles.

alike, and all classes hailed its coming, casting aside rank and wealth to join the festivities.

The palm tree and the pine grow side by side in New Orleans. That typifies the climate. It is not too tropical, because that would kill the pine; it is not too cold, because the palm could not live. The heating arrangements are designed more for beauty than utility, usually consisting of an open grate which sends much of its heat up the chimney. About once every ten years there is a gentle snowfall—just enough to flake the evergreen lawns, to deck the roses that bloom so beautifully in January, and to powder the banana plants in the yards. In summer a temperature of 100° was reached only twice in 44 years.

The Story of Over Two Centuries

New Orleans was founded in 1718, by Jean Baptiste Lemoyne, Sieur de Bienville. In 1722 it was made the capital of the great Louisiana territory, and became the center of industrial and political importance in the French territory from that date. It began to thrive in the middle part of the 18th century. In 1788 a fire demolished a large part of the city, which then took on a new and better growth. In 1795–96 the sugar industry was placed on a firm basis, and the last five years of the century were marked by the growth of flatboat commerce on the Mississippi and the development of international interests, commercial and political, of which New Orleans was the center. In the year 1803 the Louisiana territory was purchased by the United States from France. At that time the population was only about 10,000, mostly French Creoles and their slaves. New Orleans was the state capital, until 1849, an honor then conferred on Baton Rouge. In the succeeding years the progress of New Orleans was steady. It was the scene of General Jackson's victory over the British in 1815, and was captured by Farragut in 1862. The Civil War paralyzed the city's commerce, and it was not until the early part of the '70's that she regained her former footing. The first steamboat reached the city, from Pittsburgh, in 1812. The epidemics of yellow fever, which were long the scourge of the city, were ended (1878–1906) when the United States Marine Hospital Service took charge and abolished the breeding-places of the mosquitoes which carried the plague. Similarly a campaign of the United States Health Service in 1914, directed against the rats which were carriers of the bubonic plague, destroyed many unsightly and unsanitary structures. New Orleans was the scene of a World's Fair, in the form of a Cotton Exposition, in 1885. In 1891 the lynching of nine Italians accused of assassinating Chief of Police Hennessey, brought on serious diplomatic differences with Italy. Population, about 390,000.

New South Wales, Australia. The oldest and most populous British colony in Australia, now an original state of the Australian Commonwealth. It has an area of 309,432 square miles—about twice the size of California—with a population of about 2,000,000. A large part of the land is devoted to sheep- and cattle-raising, since little of it is sufficiently watered for farming. Wheat is the chief crop grown, and wool is the chief export. Gold abounds in all parts of the state, and silver, copper, tin, lead, iron, wolfram, and zinc are also mined. The greatest mineral wealth is found in the coal-fields, which yield nearly 10,000,000 tons of excellent fuel annually.

One-fourth of the state is covered with forests, and timber is an important export. New South Wales on account of its harbors and resources has the largest trade of any of the Australian states. Higher education is furnished by the University of Sydney, which is attended by more than 2,000 students. The chief cities are Sydney (capital), 829,000; Newcastle, 63,000; Broken Hill, 23,000; Bathurst, 10,000.

New South Wales shares the characteristic formation of eastern Australia—that of a narrow coastal plain, backed by the Great Dividing Range of mountains about 100 miles inland. The rapidly changing levels gives the state a great diversity of climate, from Sydney's mean temperature of 63° at the seacoast to inland temperatures ranging as high as 130°. The difference between average summer and winter temperatures at Sydney is 17°. Rainfall varies from 64 inches a year in one district in the south to 32.5 inches on the table-lands and 10 inches in the west. (*See* Australia.)

A GLIMPSE OF THE "BLUE MOUNTAINS"

This beautiful valley is typical of the scenery to be found in the great mountain range which skirts the whole eastern coast of Australia and forms the backbone of New South Wales. These mountains are rich in mineral wealth.

NEWSPAPERS. Let us join a personally conducted tour through one of the most wonderful of modern industrial beehives, a newspaper plant. Let us watch the workings of the amazing organization that brings to you every morning and almost hour by hour through the day the news of every important happening from Alaska to Patagonia, from New York to far-away China.

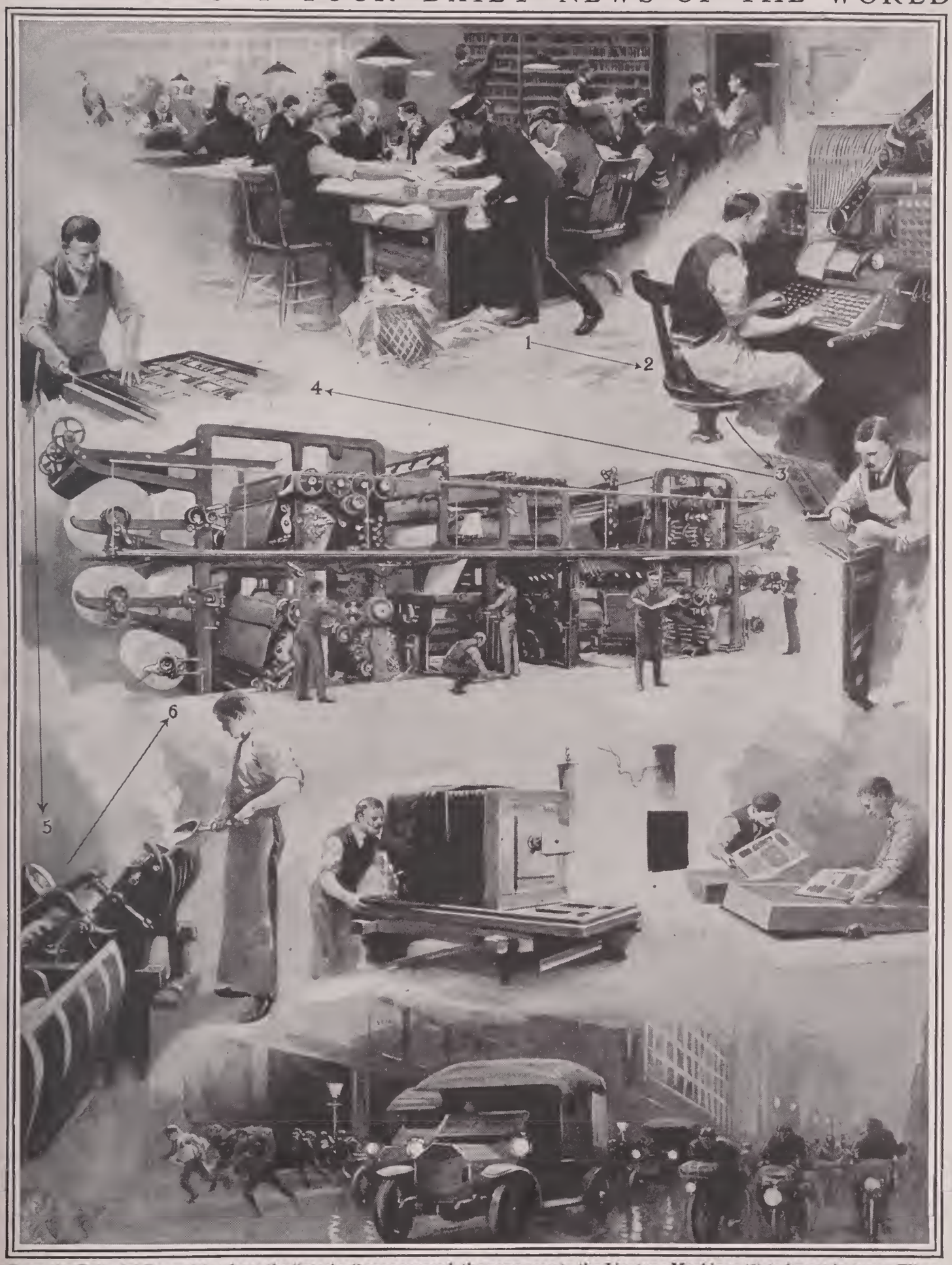
We enter a doorway marked "editorial department" and find ourselves immediately in the midst of uproar and hubbub. Men are shouting orders, boys dashing hither and thither, typewriters clicking at top speed, telephones ringing, telegraph instruments tapping off messages from all over the world, editors working over copy with feverish energy. But everybody in the room, from managing editor to office boy, is at his appointed task, each one a cog in a machine of marvelous precision.

A reporter calls up the office with an important "story" which must make the edition to be on the news-stands in half an hour. Fast as his fingers can fly, a "rewrite man," with a telephone clamped to his ear, dashes the story off on a typewriter—a few lines to a sheet. A boy rushes each sheet of copy to the city editor, who examines it quickly and passes it to the copy desk. Here it is carefully edited, a headline is written, and then it is shot through a pneumatic tube to the composing room.

Here begin the mechanical processes. We watch the copy-cutter cut each sheet of copy into two or more "takes," hang them on a hook, and apportion them among the compositors operating linotype machines (*see* Linotype). Nearly as fast as the words come from the typewriter these wonderful devices cast them into lines of solid type, which are rushed through a proof press and then speeded to the forms—large metal frames the size of a page—where the makeup man places them, still almost too hot to touch, in the space reserved for them among the columns of type already set.

All these operations have required only a few minutes. We now watch the makeup man "lock up" the form and speed it on a small truck to the steam table where a sheet of papier-mâché is pressed upon the page of type, so that it takes the impression of every letter. This papier-mâché mold is dropped through a chute to the stereotyping room, where it goes into the "casting box," and within three minutes a semicylindrical plate—an exact reproduction of the original form of type, except that it is curved to fit the presses, is cast from it (*see* Stereotyping). The plate—still so hot it cannot be handled without gloves—is hurried to the press-room, where it is placed on one of the cylinders of the gigantic mechanism, with the plates of the other pages already in place. A signal is given. Grimy pressman leap to safety, and

HOW YOU GET YOUR DAILY NEWS OF THE WORLD



From the Editorial Room (1), where the "stories" are prepared, the copy goes to the Linotype Machines (2) to be set in type. When the type and headlines are assembled (3) they are "made up" in page forms (4). Papier-mâché "mats" or molds taken from the forms are sent to the Stereotyping Room (5), where metal plates are cast. As soon as all the plates have been put in place the great presses (6) are started and papers begin pouring out, to be rushed to all parts of the city by trucks, motorcycles, and newsboys. The other pictures show cuts being made in the Photo-engraving Department.

contained in the Easy Reference Fact-Index at the end of this work

the huge mass of delicate machinery starts. At one end we see an enormous roll of white paper—five miles of it. At lightning speed the paper is fed into the press. And far too fast for the eye to count them—300,000 an hour in the most modern plants with a battery of presses—our completed newspapers, cut and folded, just as they come to us, leap forth at the other end. (*See* Printing.)

Endless belts whirl the papers out to the distributing and mailing rooms. Chugging automobiles are piled high and rush at breakneck speed to delivery stations throughout the city. Other automobiles dash to make fast mail trains for distant points, while dozens of newsboys seize their quotas and hurry to the street to shout the news of some great man's death, an important political development, or a terrible tragedy half an hour after it has happened.

Still more astonishing to the uninitiated is the device by which news that is received within the last few minutes before press time is printed in the form of brief bulletins on the first page. This device is called the "fudge-box." A space of any desired size, usually two columns wide, is left blank on the stereotype plate. Exactly corresponding to this blank space on another cylinder is an arrangement into which type can quickly be fitted and clamped in place. Suppose a baseball game is in progress. A reporter in the press box in the grandstand with a telephone before him reports each play as it is made. Another man in the fudge room of the newspaper office repeats the plays to the operator of the fudge linotype, so that each play is recorded on the metal slugs even before the applause in the grandstand has died down. Perhaps 30 seconds before the giant press is started, the type thus set is rushed to the special fudge cylinder and clamped directly in place without the necessity of casting a plate from it. Thus it often happens that the newsboys are shouting the result of a ball game on the streets before half the crowd has left the park.

Vast Expenses of a Great Newspaper

Such speed is possible only because a modern metropolitan newspaper is one of the most efficiently organized industries in the world. Besides professional newspaper men—editors, copy readers, and reporters—masters of at least half a dozen highly skilled crafts are required in its production. The amount of money represented by a newspaper plant and the cost of production are enormous. The two or three cents which you pay for your copy does not pay for the white paper alone.

Three mechanical factors have made their influence most keenly felt in producing the modern newspaper. They are: (1) the development of the printing press; (2) the invention of the linotype, the monotype, and allied devices; and (3) the invention of the telephone, the telegraph, and wireless telegraphy. The first two of these factors made great speed of production and enormous volume of product possible. The third annihilated time and distance and made it possible to assemble the news of the world overnight.

Although there are many newspapers in Europe and elsewhere which "cover" the news of the world comprehensively, the dailies of the great cities of the United States undoubtedly offer the most highly developed examples of modern journalism. This is due not only to the completeness of their mechanical equipment, but also to their enterprise, engendered by keen competition, which causes them to go to any expense to score a "beat" or "scoop" on their rivals.

How New Our Newspapers Are

Nearly all the great strides in newspaper-making have come in the last hundred years. It was not such a far cry from the *Acta Diurna* ("Daily Events") of ancient Rome—short bulletins of battles, fires, elections, etc., compiled by government officials and posted up in public places—to the official *Notizie Scritte* which the government of Venice issued in the 16th century. This was a hand-written bulletin, and the written journal persisted long after the use of printing began, largely because government censors kept a close watch on printed newspapers. About the same time private presses in other cities of Europe began issuing news-letters from time to time reporting the most remarkable events of the time. In 1615 the news-letter developed into the first regular weekly newspaper, the German *Frankfurter Journal*. The first regular newspaper in England was the *Weekly Newes*, started in London in 1622. The freedom of the press from censorship before printing came first in England in 1695, and marked a great forward step in the history of newspapers. Boston was the home of the first American newspaper, *Public Occurrences* (1690), which was speedily suppressed by the governor of Massachusetts. Next came the *News-Letter* (1704) and the *Gazette* (1719), also published in Boston. In 1729 Benjamin Franklin started the weekly *Pennsylvania Gazette* at Philadelphia, later merged with the *North American*, which is still one of the leading papers of the United States.

The modern American newspaper is divided into five departments. They are the editorial, circulation, business, advertising, and mechanical. The principal executives are the publisher, who is usually the proprietor and editor-in-chief; the business manager; the managing editor and the advertising manager. Each department chief is responsible for the smooth and orderly working of his department, and the activities of all the departments must dovetail together with clocklike precision.

The editorial staff is headed by the managing editor, who is in direct charge of gathering, editing, and publishing the news. Coöperating immediately with the managing editor are the city editor, the telegraph editor, the news editor and the makeup editor. The reporters, divided into "general assignment" men and those who cover certain "runs" such as the courts, City Hall, police station, etc., work directly under the city editor and his assistant. Everything written for the newspaper, including telegraph and local news, financial news, "feature" articles, musical and dra-

matic items, and correspondence, must go through the hands of sub-editors, or copy readers, who prepare the copy for the printer, correct it, "trim" it to allotted space, eliminate mistakes, and write the headlines.

The telegraph editor has charge of editing all news that comes into the office over the wires. On a few of the largest newspapers a foreign editor is in charge of his own paper's foreign service and all foreign news gathered by other agencies. Several copy readers usually assist the telegraph editor, who is known commonly as "head of the telegraph desk." The makeup editor supervises the arrangement of type in forms in the composing room. With the managing editor, the news editor, and the city editor, he determines in what column and on what page each important article is to appear, and helps to decide what to "play up" and to "play down." Frequently news stories are given prominence rather because they conform to the political or business policy of a newspaper than because of their intrinsic importance or interest. Sporting news is gathered by the sporting editor and his assistants, who are usually recognized experts in various lines of sport. In like manner musical, dramatic, and financial news is written by men or women who make a specialty of these lines.

Coöperative News Bureaus

In the larger cities the newspapers usually form a coöperative bureau to cover all routine news. This is mimeographed and sent to all newspaper offices simultaneously through pneumatic tubes. So thoroughly organized is the business of gathering news that scarcely anything of importance can happen in a large city without the newspapers becoming aware of it. Trained reporters develop an uncanny "nose for news" which enables them to ferret out information despite the most strenuous efforts to conceal facts; and frequently this quality, together with a broad acquaintance, enables them to score "scoops," or exclusive stories. To achieve this the good reporter will perform prodigies of labor, sometimes at the risk of life and limb.

Not all of the popular impression that a newspaper man's life is picturesque and exciting is erroneous, although it is true that hard work of the most exacting nature occupies most of his hours on duty. The newspaper man learns to meet all sorts of men and women on terms of easy familiarity. He can talk to a bank president or a senator as easily as to a police sergeant. His work takes him everywhere, keeps him constantly on the alert, gives him a smattering of information on a multitude of subjects. Many reporters who achieve a reputation for ability, energy, and reliability rise to positions of eminence not only in journalism but in politics, business, and other lines.

There are in the United States three large news-gathering agencies which cover the world with a fine-tooth comb and supply all the important newspapers with telegraph and foreign news. The greatest of these is the Associated Press, a coöperative association comprising about 1,000 newspapers. Its correspondents are everywhere, even in the most remote parts of the world, and arrangements with large foreign news-gathering agencies enable it to keep America minutely informed upon all important events abroad. All the revenues of the Associated Press are derived from assessments levied upon its members. It has no stock, no dividends, and no profits. An average of 50,000 words—enough to fill 35 columns—is received and transmitted daily through the more important "A. P." offices, which have at their service more than 50,000 miles of telegraph wire and reach every corner of America.

Other important news-gathering associations in the United States are the International News Service and the United Press. The latter serves chiefly news for afternoon papers. There are, besides these, innumerable newspaper syndicates which supply cartoons, short stories, fashion notes, and other so-called "features" for the magazine pages. This branch of newspaper enterprise has grown tremendously in recent decades. The demand for photographs also has increased so enormously that a number of concerns have grown to great size and wealth solely through supplying these to newspapers. The photo-engraving department of newspaper plants has also come to hold an important place. Many new processes, particularly the rotogravure process and various methods of color printing, novelties only a few years ago, now are considered indispensable to a great modern newspaper (*see* Engraving).

The Great Field of Magazines

Scarcely less remarkable than the development of the newspaper has been that of the magazine, particularly in the United States. The name magazine was first used in connection with "The Gentlemen's Magazine," published monthly beginning in 1731 and described as "a monthly collection to treasure up as in a magazine articles on the subjects with which it proposes to deal." From this beginning, magazines have developed and specialized until now we have not only "general interest" and fiction magazines, but trade journals, magazines for boys, and so on, each variety so specialized as to constitute almost a separate profession for writers and editors.

The enormous task of printing magazines with circulations running into the millions would not be possible were it not for the invention of the electrotyping process, by which several exact duplicates of the plates can be made, so that the magazine can be printed on several presses at once (*see* Electrotyping). The invention of color printing was another advance in the printing art of tremendous importance to the magazine. Huge binding and stitching machines turn out the completed magazines at an almost incredible speed. But with all these wonderful mechanical devices, none of the large periodicals could be made from cover to cover in the short time intervening between issues. The great bulk of the contents is in type weeks and months before the date of the issue in which it is to appear.

The MAN WHO DISCOVERED *the* LAWS *that Rule the Universe*

NEWTON, SIR ISAAC (1642–1727). "Nature and Nature's laws lay hid in night" for ages, but light slowly broke in the 17th century. Last of a great line of forerunners of the dawn, Galileo died in January 1642. That same year saw the birth of one greater than he, destined to shed the full light of day on the work of his predecessors — Isaac Newton, who was born on Dec. 25 (old style), 1642, at Woolsthorpe, England.

To compare the 17th century with the 20th is like comparing a stagecoach and an airplane or a wax candle and an electric light. In ideas the two centuries are even farther apart than in inventions, and the difference is largely due to the sudden flood of light poured on the order of the world by Newton. To realize what his discoveries mean to us, therefore, we must try to look a little way into the minds of men of two or three centuries ago.

In the first place, the iron clutch of *authority* on beliefs was only gradually being hammered loose by observation and experiment. "Authority"—do you know what that means? It means that when you asked a question about anything in the universe, you were answered, not by "Watch and find out," or "Try it and see," but "Here is what Aristotle, or St. Augustine (or some other writer dead a thousand years) says about it." Only a few bold souls realized that the one great "authority" on Nature is Nature herself, and had dared to put their questions to that greatest of teachers in the form of experiments

The Dim Conception of Natural Law

Again, the bare idea of *invariable natural law* was as yet vague and unformed. Of course, men had always recognized a certain order underneath Nature's apparent confusion. The sun always rises in the east and sets in the west; summer and winter, day and night, always follow one another; heavy objects dropped in mid-air always fall to the ground. But to most people, amid all the as yet incalculable waywardness of wind and weather and life and death, this seemed merely like the queer streak of reasonableness one sometimes finds in otherwise capricious persons—a riddle without an answer. Great minds from Heraclitus to Kepler, indeed, had dreamed of harmonizing the facts of Nature by some underlying universal law; but their attempts were mainly wild guesses, for lack of the exact knowledge furnished by observation and experiment.

Like the Kingdom of Heaven, the wonderland of science was at hand and all about them in the commonest everyday things; but its truths could not be understood except in the light of natural law. What passed for natural science in most people's minds before Newton's time was a mere hash of childish curiosities and far-fetched fables. The English Royal Society had what was called a "mermaid's bone" and a "unicorn's horn," not to speak of a stag beetle whose horns worn in a ring were said to be good for rheumatism! What we call the "natural sciences" had no place in a "liberal education" at that time, for the very good reason that as yet they scarcely existed. The nature of light, of heat, of sound, and of electricity were unknown; chemistry was still befogged with alchemy, and astronomy with astrology. The farthest outposts of scientific knowledge in the inorganic world were the discoveries of Galileo and Kepler in astronomy, mechanics, and optics (*see* Astronomy; Galileo; Kepler).

> **THE HUMILITY OF TRUE GREATNESS**
>
> *Though Newton's contributions to science were among the greatest ever made by any one man, he had the modesty of true genius. "If I have seen farther, it is by standing on the shoulders of giants," he wrote in reply to one who complimented him on his researches. And shortly before his death he wrote, "I seem to have been only a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great Ocean of Truth lay all undiscovered before me."*

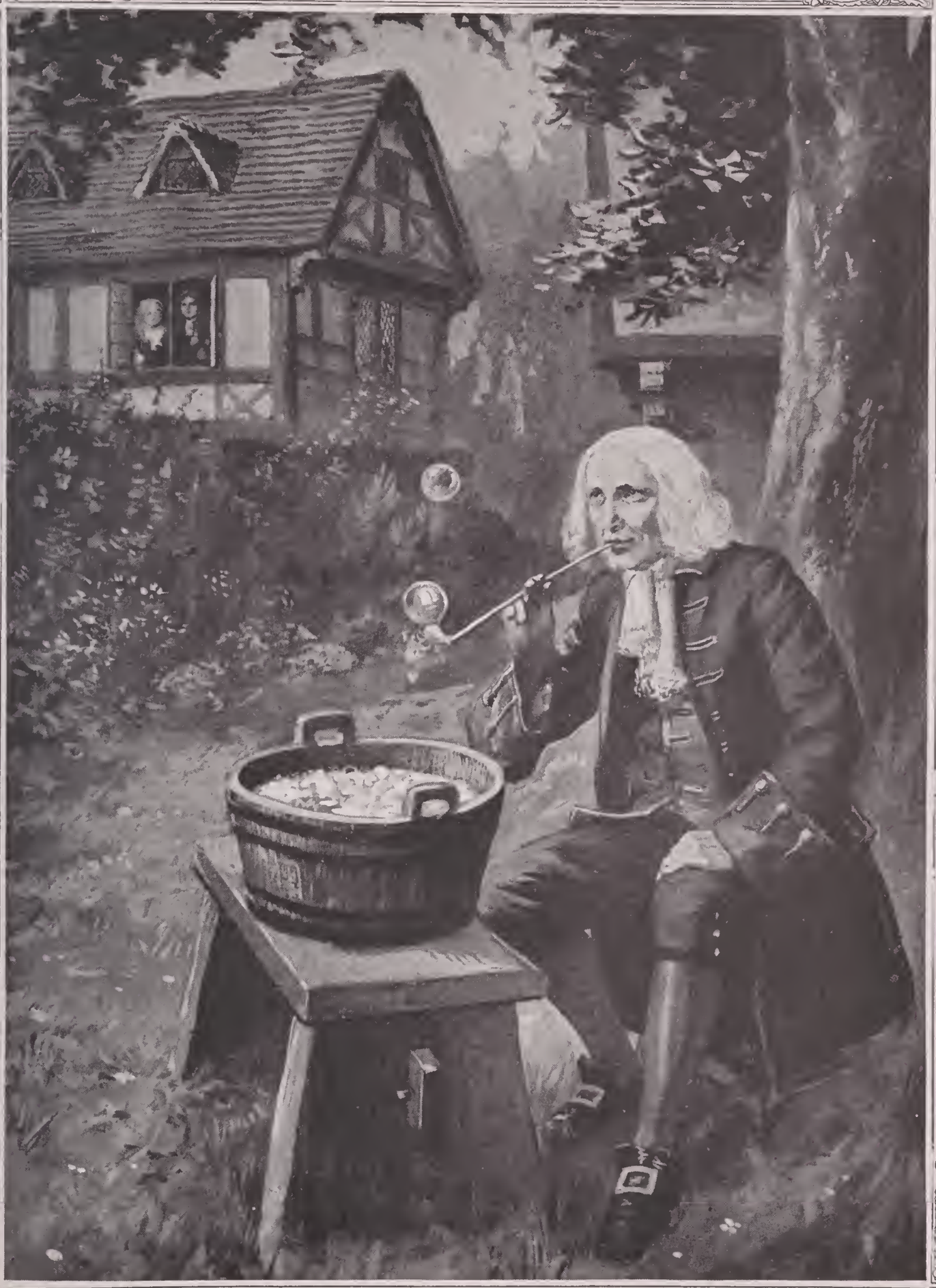
Such was the intellectual world into which Newton was born. He was the son of a gentleman farmer, who, dying before his only son's birth, left his widow in very moderate circumstances.

More Interested in Living Science than Dead Language

At school young Isaac, according to his own later accounts, was but an idler, until he was aroused by the desire to outstrip a young bully who stood above him in his classes. The classical Greek and Latin education of the times must, indeed, have been deadly dull to a mind like Newton's, all alive with curiosity about the universe of nature. Not being able to find out what he wanted to know in school, the boy "tinkered around" with tools, making now a windmill, now a water clock, and now a carriage to be propelled by the occupant—not to speak of sundials, and even doll furniture for little girl friends.

One science, to be sure—mathematics—did form a part of "every gentleman's education," and in this Newton was a discoverer almost as soon as he was a graduate. He developed the new method of calculus (or, as he called it, "fluxions") in the year of his graduation from Trinity College, Cambridge University (1665). The method is of great importance, not only in itself, but as a tool later used in proving the theory of gravitation, the germ of which seems to have lodged in Newton's mind about the same time. The "apple story" is told elsewhere (*see* Gravitation). The calculations of the moon's orbit, which Newton made then to test the gravitation theory, agreed "pretty nearly" with the known facts, but "to a mind like Newton's 'pretty nearly' is as bad as 'not at all,'"

READING THE SECRET OF LIGHT IN A BUBBLE



It used to amuse Sir Isaac Newton's neighbors to see the great man in his garden blowing soap bubbles with that long-stemmed pipe. But it amused Sir Isaac himself a good deal more, for he was using these bubbles to find out why a sunbeam, striking these pretty globes, breaks up into all the colors of the rainbow. Newton's theory of light was the first of his great contributions to science.

contained in the Easy Reference Fact-Index at the end of this work

and so gravitation was laid aside for the time being.

Now began the series of careful, logically conducted experiments on light and color, which were to lead to the first of his great discoveries in natural science. By 1669, the year in which he was appointed professor of mathematics in Cambridge University, Newton had demonstrated the compound character of light and the fact that color resides not in the object but in the light itself. These discoveries were not made public, however, until 1672, when Newton reported them to the Royal Society. His studies of light also led him to the invention of the reflecting telescope.

Newton's Theory of Light

Newton explained light by the "corpuscular" theory —that is, that it was caused by a stream of minute particles or "corpuscles," given off at a high velocity by a luminous body. Scientists later adopted the "undulatory wave" theory (*see* Light). But since then the discovery of radium and the manifestations of radioactivity have proved the existence of minute particles moving with the high speeds needed for Newton's corpuscular theory, and now we are not so sure that Newton was wholly wrong on this point. (*See* Atoms and Electrons; Radium.)

Just when Newton began to study again the problem of gravitation is not known, but in 1684 the astronomer Edmund Halley stumbled upon the fact that the quiet Cambridge scholar had worked out in solitude the principles of the theory. At Halley's urgent desire, Newton set them forth in the great work generally called the 'Principia' (*Philosophiae Naturalis Principia Mathematica* or 'Mathematical Principles of Natural Philosophy'). It is said that there were not 12 men in Europe capable of understanding this book at its publication in 1687. It has been called the greatest single contribution to science ever made by any one man. It established the ideas of "mass" and "force," the principles of the mechanics of the heavenly bodies, and the science of theoretical mechanics as its exists today.

A Great, Gentle, Modest Soul

Far from seeking recognition for his work, Newton shrank from publicity to a degree that is almost unknown today. Controversy was distasteful to him, and the dispute with the German scientist G. W. Leibnitz over the calculus (which the two men seem to have invented independently) was the exception to a rule deliberately adopted and closely adhered to. But when James II interfered illegally with the universities, Newton took an active part in defending the University of Cambridge. Later he was elected to a seat in the Convention Parliament which seated William and Mary on the throne in place of James II. His friend Charles Montague, chancellor of the exchequer, then appointed him to a position in the mint, in 1696, and in 1699 he was made its head.

Now we may see our philosopher enjoying a modest yet ample fortune—"three lackeys to his coach and as many servants indoors." A charming and devoted niece kept his establishment running smoothly, and his income permitted him to dispense his bounty generously to needy men of science and members of his own family. In 1703 he was elected president of the Royal Society, "the highest honor in science to which an Englishman could aspire." Knighthood at the hand of good Queen Anne followed in 1705, with the prefix "Sir" to his name. So peace and prosperity were Newton's lot until his death in 1727. His ashes lie today among the great in Westminster Abbey.

A well-known story—which, however, is not certainly true—tells how one day Newton's little dog Diamond, while alone in his master's study, overturned a candle which set fire to the great scientist's papers, and destroyed the work of years. "Ah! Diamond, Diamond! Thou little knowest the mischief thou hast wrought!" is said to have been Newton's only comment. Whether true or not, the story illustrates the serenity of Newton's temper.

NEW YEAR'S DAY. When we celebrate the first day of the new year, we are following a custom that dates back to the very dawn of civilization; for nearly all peoples have observed a new year's celebration, though the time has varied widely—sometimes as early as the autumnal equinox (about September 21), sometimes as late as Midsummer's Day (June 22).

If we could travel around the world on a magic carpet and peep at the new year celebrations in the various countries, what a wonderful variety of customs we should find! If you were in China you might think that the Chinese were celebrating all their holidays for the year at once, for they close their shops for several days while they make merry with feasts and fireworks and the general exchange of gifts and good wishes. In preparation every debt must have been paid, every house swept and cleaned, and each person furnished with holiday clothes and a supply of preserved fruits, candies, and ornamental packages of tea to give to his acquaintances.

The Japanese New Year festival is perhaps even gayer. No matter how poor he may be, everyone provides himself with shining new clothes and takes three days off from work to visit his friends or entertain them at his home. Every gatepost is adorned with dark green pines and feathery light green bamboos, while over the doorways hang vivid red lobsters and crabs, and scarlet tangerine-like fruits, symbolical of long life and happiness. The streets are thronged with happy children playing battledore and shuttlecock the whole day long, and everyone beams with joy, bowing and wishing the compliments of the season even to perfect strangers.

Throughout the rest of the Orient, too, the opening of their New Year is celebrated with elaborate festivals that correspond to the Christmas celebrations of Western countries. In some European nations also, especially France and Scotland, New Year's Day is a more important holiday than Christmas. If you were a French peasant child you might put your *sabot* (wooden shoe) on the hearth for a gift at Christmas, but grown-ups in France exchange gifts at the

New Year festival, at which time there are family parties, with much merrymaking and a general exchange of visits.

Scotland celebrates New Year's Eve with a heartiness nowhere surpassed. The old-time tradition that to be "first-foot" in a house brings luck for the whole year sends throngs of midnight revelers into the streets of Scotch cities on New Year's Eve, each with his box of cakes and his spiced ale, for in order to insure his host a bounteous year he must not enter empty handed.

Some cities have their special local customs. Formerly in Petrograd (Russia) the New Year was ushered in by a cannonade of one hundred shots fired at midnight. In some Scandinavian cities also, the New Year is welcomed with a noise of firearms, while the Yuletide celebration continues until Twelfth Night (12 days after Christmas), as in Italy.

In America the observance of New Year's Day is as varied as the character of the people that make up the New World. Each city and rural district has its New Year's Eve "watch night" service in the churches, its dancing and theater parties, its gay street revelers; and New Year's Day is a time for general entertaining and visiting. The former custom, however, of keeping open house and making New Year's calls has practically disappeared.

March 25 was the usual date for beginning the new year in most Christian countries in the Middle Ages, and England retained this date until 1751. In those countries which still use the Julian calendar New Year now comes on January 13 of our reckoning (*see* Calendar). The Jewish New Year, which opens with Tishri, our September, is called the "feast of the trumpets" and lasts for 48 hours. The Chinese New Year now coincides with that of the Western World.

WEALTH *and* POWER *of the* "EMPIRE STATE"

In the Catskills—View from Otis Summit across the Hudson Valley

NEW YORK. The Empire State! Greater in size than any one of half a dozen European countries, New York is nevertheless small in area as compared with most of the states of the United States, for more than half the number surpass it in extent. It is, however, the Empire State because it is greatest in population, in commerce, and in manufactures; because of its influence on the history and development of the United States; because it controls the great eastern gateway to the country and the highway to the West; and because New York City is now the greatest financial center of the whole world.

Extent.—East to west, 326 miles (412 miles including Long Island); north to south, 312 miles. Land area, 47,654 square miles. Population (1920 census), 10,384,829.

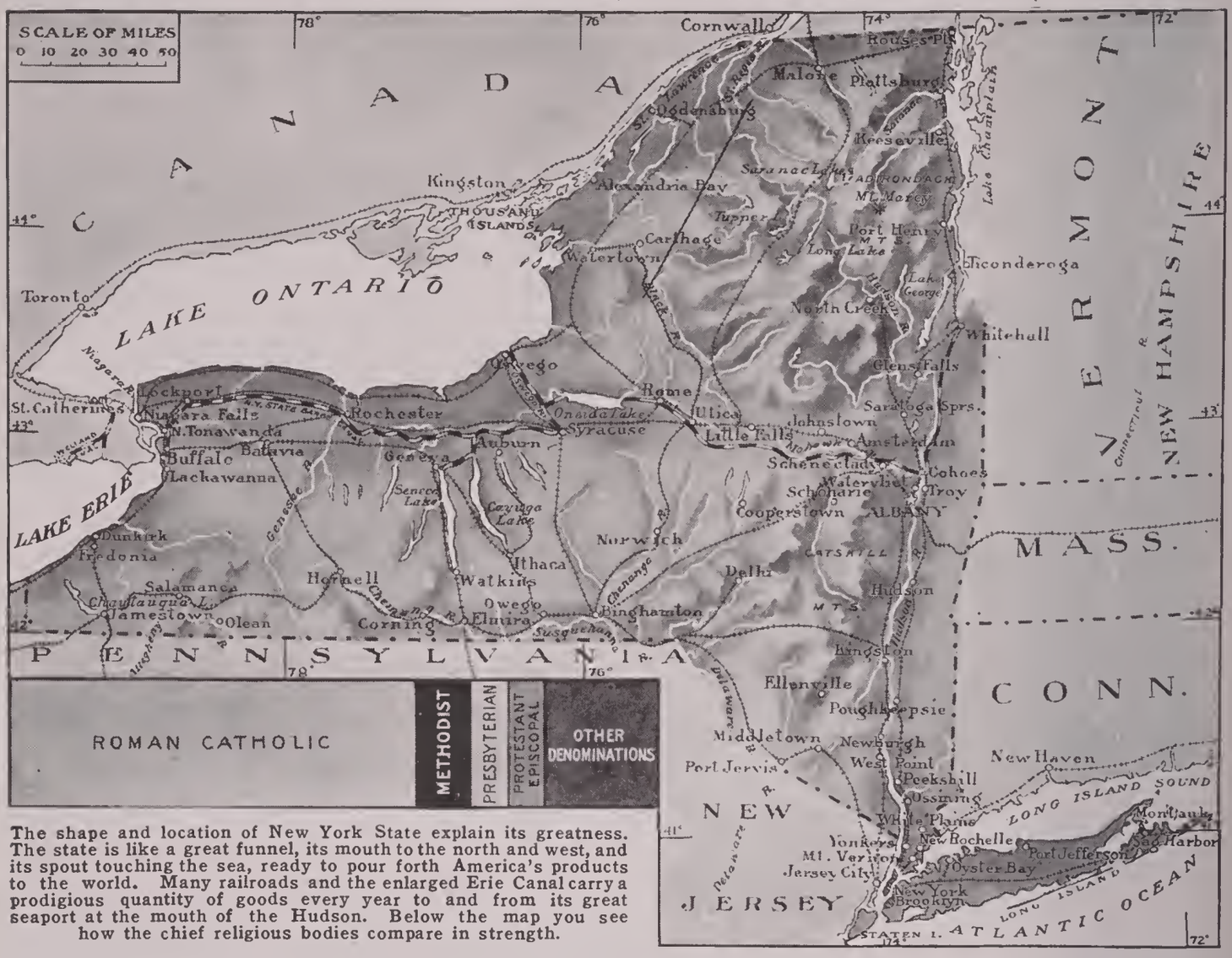
Natural Features.—Chief mountain groups, Adirondacks (highest point, Mount Marcy, 5,344 feet) and the Catskills. Borders on lakes Ontario, Erie, and Champlain; chief interior lakes, George, Oneida, Cayuga, Seneca, Canandaigua, and Chautauqua. Principal rivers: Hudson and Mohawk; St. Lawrence and Niagara on the boundaries. Greatest waterfall, Niagara, about a mile wide and 160 feet high.

Chief Industries.—Manufactures: men's and women's clothing, books and periodicals, textiles, foundry and machine-shop products, tobacco manufactures, lumber and timber products, millinery and lace goods, boots and shoes. Agriculture: hay, potatoes, fruit, and vegetables. Steam railroads, 8,534 miles; electric roads, 5,633 miles.

Leading Cities.—New York City (over 5,600,000); Buffalo (510,000); Rochester (296,000), Syracuse, Albany (capital), Yonkers, all over 100,000; more than 20 other cities with a population above 20,000.

Take away New York City, however, and New York State loses not only its financial preëminence, but it is left with a smaller population and a smaller volume of manufactures than Pennsylvania with Philadelphia subtracted. Is the Empire State, then, nothing in itself—merely a background and appendage to the imperial city of New York?

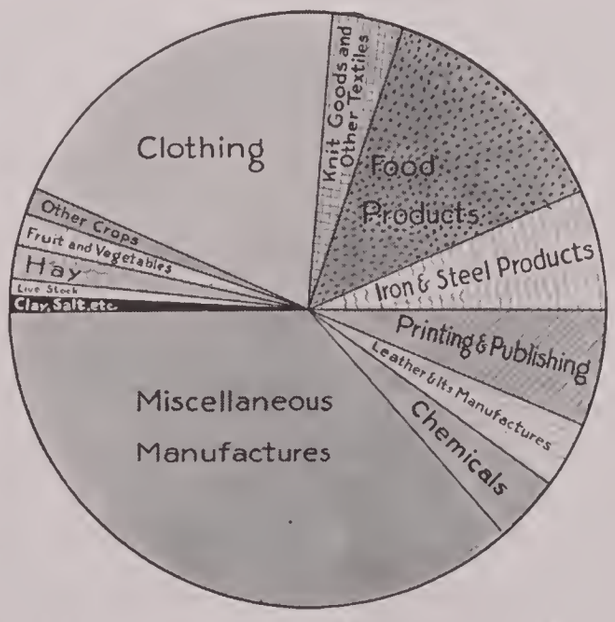
THE VAST FUNNEL FROM LAKES TO OCEAN



The shape and location of New York State explain its greatness. The state is like a great funnel, its mouth to the north and west, and its spout touching the sea, ready to pour forth America's products to the world. Many railroads and the enlarged Erie Canal carry a prodigious quantity of goods every year to and from its great seaport at the mouth of the Hudson. Below the map you see how the chief religious bodies compare in strength.

No; the greatness of the state and the city can scarcely be weighed separately, so much does each contribute to the other's welfare and prosperity.

The tiny scrap of coast where New York State thrusts its shoulder down between New England and New Jersey is commercially worth all the rest of the United States coast line. For that bit of seacoast has one of the finest harbors in the world, nearer to Europe than any other important harbor of the United States except Boston. Yet without the inland highway to the West through the Mohawk-Hudson Valley, this magnificent port would never have made New York City the world metropolis that it is, and without this commercial advantage New York's abundance of water-power and nearness to the Pennsylvania coal beds would probably not have made the state supreme in manufactures. The Empire State is great for many reasons, but above all because of the geographic factors which make it the warder of our greatest gate, and permit it to stretch out one hand to Europe and the other to North America's teeming interior.



A glance at this products chart shows you what an immense variety of manufactures comes from the Empire State.

Also New York has an imperial variety of geographic forms within its borders—a sample, or at any rate a relic, of almost every geographic feature of the United States that can be named. There are, to be sure, no active volcanoes, but some excellent samples of volcanic rock are seen in the black trap of the towering Palisades of the Hudson. There are no glaciers, but you can find many beautiful examples of the work of the glacier that covered nearly the whole of the state during the Ice Age. There

NEW YORK IN SOME OF ITS SCENIC ASPECTS

Lake George

Wilmington Notch, Ausable River

The Palisades

Hudson River

Delaware River

Long Lake

While the great commonwealth of the Hudson and Mohawk is notable for its wealth and industry, it has its charming aspects as well—jewel-like lakes, frowning cliffs and mountains, majestic rivers and quiet streams wandering through rich valley farms. Lake George in the eastern part of the state, is a well-known and attractive vacation region. Wilmington Notch is one of the many scenic spots in the Adirondack Mountains, while the Palisades loom above the Hudson within sight of New York city. In striking contrast are the upper valleys of the Hudson and the Delaware with their scenes of restful beauty. Long Lake, 14 miles long and one mile wide, is in the Adirondack.

contained in the Easy Reference Fact-Index at the end of this work

NIAGARA FALLS IN ITS "WORKING CLOTHES"

This is the mill district on the American side of Niagara Falls, where the roaring giant is harnessed to machinery. It is estimated that the total daily working energy of the falls is more than 700,000 horse-power. Should this power all be utilized, the scenic beauty of the falls would disappear, and so Canada and the United States have entered into a treaty restricting the amount of water to be diverted for power.

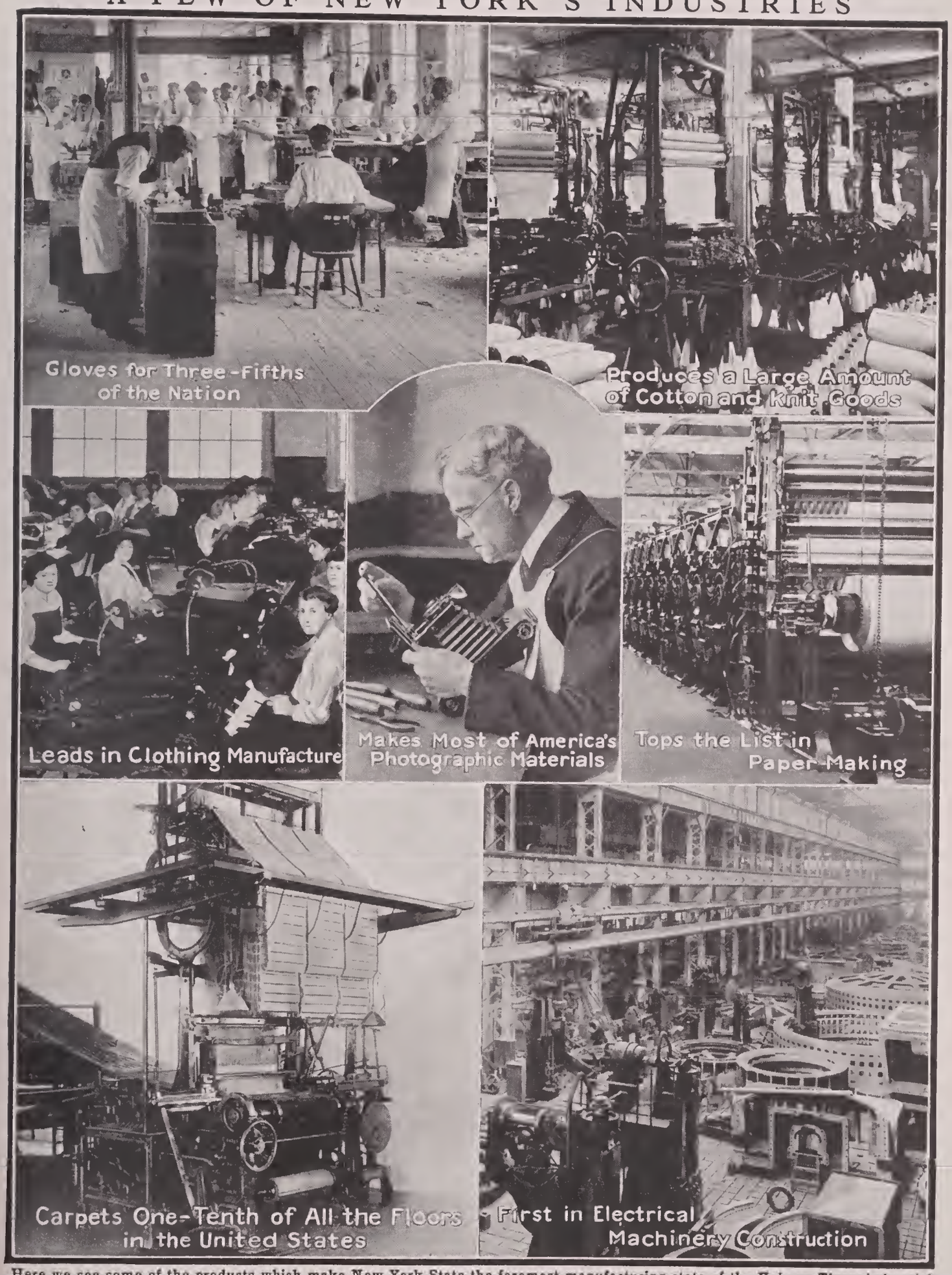
are no Saharas, but some very pretty miniature deserts exist in the sand dunes of Lake Ontario and Long Island. As for rivers, the great St. Lawrence forms part of its northern boundary; the majestic Hudson is all New York's own; the Mohawk and its tributaries form one of the busiest industrial river systems in the world; and not only matchless Niagara, but a score or more of headlong streams hurry down wonderful falls, cascades, and rapids. Lakes Champlain, Ontario, and Erie form part of the state's boundaries, and within its area are historic Lake George, Lake Chautauqua—the highest navigable body of water (1,512 feet) east of the Rocky Mountains—Lake Oneida, and the beautiful "Finger Lakes," Cayuga, Seneca, and the rest, together with many another charming body of water. As for islands, the city of New York is built on what may almost be called an archipelago; Long Island, which measures 110 miles by 20, is the greatest island possession of the United States outside of Porto Rico, Hawaii, and the Philippines; and the picturesque Thousand Islands in the St. Lawrence, some of which belong to New York, are favorite summer resorts. If you speak of mountains, the Adirondacks and Catskills are famous and much frequented as health and pleasure resorts, the former especially for the treatment of tuberculosis. Valleys, plains, chasms, gorges, natural bridges—there is no space to mention them.

THE IMPOSING CAPITOL AT ALBANY

The original designs for the imposing structure of white granite that houses the government of New York State were made by Thomas Fuller, the same architect who designed the Parliament Buildings for Canada, and the buildings show many resemblances. This is one of the few state capitols which departs from the pattern set by the National Capitol in Washington.

The foundations of New York's commerce were really laid in the long-ago geological days when the Atlantic coast was tipped down into the water; this drowned the Hudson valley up to Troy, and made islands of the lands near the river's mouth, and a fine sheltered port right within its jaws—not to speak of an inshore waterway to New England through Long Island Sound. Henry Hudson, in 1609, was thus able to steer the *Half Moon*, flying

A FEW OF NEW YORK'S INDUSTRIES



Here we see some of the products which make New York State the foremost manufacturing state of the Union. These industrial honors are shared between New York City and the large upstate communities. Rochester is world famous for photographic materials, while Schenectady is foremost in electrical supplies.

contained in the Easy Reference Fact-Index at the end of this work

FIELDS, ORCHARDS, AND DAIRY FARMS

the Dutch flag, 150 miles up the river that bears his name, past the present site of Albany. The next important factor is the Mohawk valley, which enters the Hudson valley at right angles just where the Hudson River ceases to be navigable. The presence of several waterfalls makes the Mohawk unnavigable; but the valley not only opens a gap through the Appalachians, but offers the best highway from the Atlantic coast to what we know as the Central States.

These three pictures give us a fine idea of what country life in New York State is like. The upper picture shows one of the dairy and cattle farms. Of the lower two, the one on the left shows a field of buckwheat at harvest time, and the one on the right, an apple orchard.

New York was the first of the original thirteen states to cede to the Federal government (in 1781) its claim on the Old Northwest; and its reward was found in a rise to power with the growth of the states formed from that territory. First, however, the chain of water transportation had to be completed, joining east to west. In 1807 Fulton's steamboat, the *Clermont*, made its first trip between New York and Albany. Three years later the first steps were taken toward the realization of the dream of a water link between Lake Erie and the Hudson River along the Mohawk valley. The Erie Canal, finished in 1825, put new life into western New York State, made Buffalo "the great doorway of the Inland Seas," and initiated the era of canal-building as well as the further development of the Central States.

The Erie was only the greatest of New York canals; no other state during the "internal improvement" period had such a system of inland waterways, because none had such good natural canal routes. Railroad building began early in New York (in 1831), but the canals held their own and kept freight rates down for 25 or 30 years. The railroad competition and political mismanagement caused a period of neglect and ruin for the whole New York canal system. There are at present more than 8,500 miles of steam railroad and more than 5,600 miles of electric railroad track in New York—figures by the side of which the 800 miles of improved inland waterways seem utterly insignificant. Yet the recently completed New York State Barge Canal is expected to play as important a part in commerce as its predecessor. It is a notable piece of engineering, calling for the new construction or improvement of 440 miles of canal,

and the canalization of 350 miles of intervening lakes or rivers, making a total length of 790 miles, with 75-foot breadth and a channel 12 feet deep in the main canal, and a total of 57 concrete locks. Barges of 2,000 tons are towed or driven by their own power over the general route of the old Erie Canal, and branch lines connect with lakes Cayuga and Seneca, with Lake Erie at Oswego, and with Lake Champlain from Troy on the Hudson River. Great as is the foreign commerce of New York, its domestic commerce is even greater.

Of New York State's manufactured products—which total nearly four billion dollars in value—more than half are made in New York City, and most of the remainder in the water-power towns. No other state has developed water-power to such an extent as New York. True, the manufactures have generally outgrown the water-power and had to call to their aid Pennsylvania coal, but water-power furnished the original impetus. Nearly all important New York towns are so situated as to command either water-power or water transportation, or both. In fact, nearly three-fourths of the state's population live within two miles of the state waterways.

First in the water-power list, of course, is the enormous power of Niagara Falls used as electricity at the city of Niagara Falls, and transmitted to Buffalo and even as far as Syracuse. The upper Hudson, the Black River, the Oswego, and the Mohawk and its tributaries, all furnish important electric power. The chief cities away from the Hudson-Mohawk system, and the rivers draining from the Adirondacks, are Binghamton on the Susquehanna, and Elmira on the Chemung River. In the chain of mill towns along the Mohawk valley are made about three-fifths of the gloves and mittens produced in the United States, nearly one-third of the knit goods, a third of the carpets, and a large part of the cotton goods.

New York State leads in the manufacture of clothing, the publication of newspapers, periodicals, and books (the first and second industries in importance); the making of paper and wood pulp, furniture, electrical machinery, fur goods, photographic materials, tobacco products, paint and varnish, and musical instruments. It is second in dairy products; and third in foundry and machine-shop products (the third important New York industry), in textiles, and in packed and dressed meats. A better, though still faint and inadequate, idea of the wonderful range of New York's manufacturing interests may be gathered from the articles on the state's important cities.

New York state banks have a heavier capitalization and larger resources than those of any other state. While Wall Street, in New York City, is the heart of the system, Albany, Buffalo, Troy, Rochester, Binghamton, Syracuse are important secondary centers.

Until 1890 New York was the first agricultural state in the Union, and it still has great farming interests, though now exceeded in total value of crops by several western states. New York's soils are of great variety, and all except about a third of the state, comprising the mountain areas and some sandy regions, are good for farming. Hay and forage crops lead, and encourage the production of milk, for which New York City and the other great towns furnish ample markets. New York leads in the production of condensed and fresh milk, though of late Wisconsin has led in butter and cheese. Grains are still important crops, though the American wheat center is no longer in New York. Potatoes are extensively grown on Long Island and in the western part of the state, apples in the Hudson and Genesee

WHERE THE VASSAR GIRL IS "MADE"

This is the "alma mater" of the Vassar girl, the famous college near Poughkeepsie. Every Vassar graduate carries in her memory through life a picture of the beautiful place which has been home to her most of the time during a period of four years. The first building on the right, opposite the lake, is the Chapel. Next, to the left, is Taylor Hall, the Art School of Vassar. Next is the Library. Then comes the quadrangular group of buildings made up of North Hall, Lathrop Hall, Strong Hall, Davidson House, Raymond House, and Rockefeller Hall, familiarly known as "Rocky." In the center of the whole group, the largest structure of all, is the Main Building, around which are grouped the "Gym," the Maids' Club, the Conservatory, and the Museum.

LAKES THAT KEEP NEW YORK FROM BEING THIRSTY

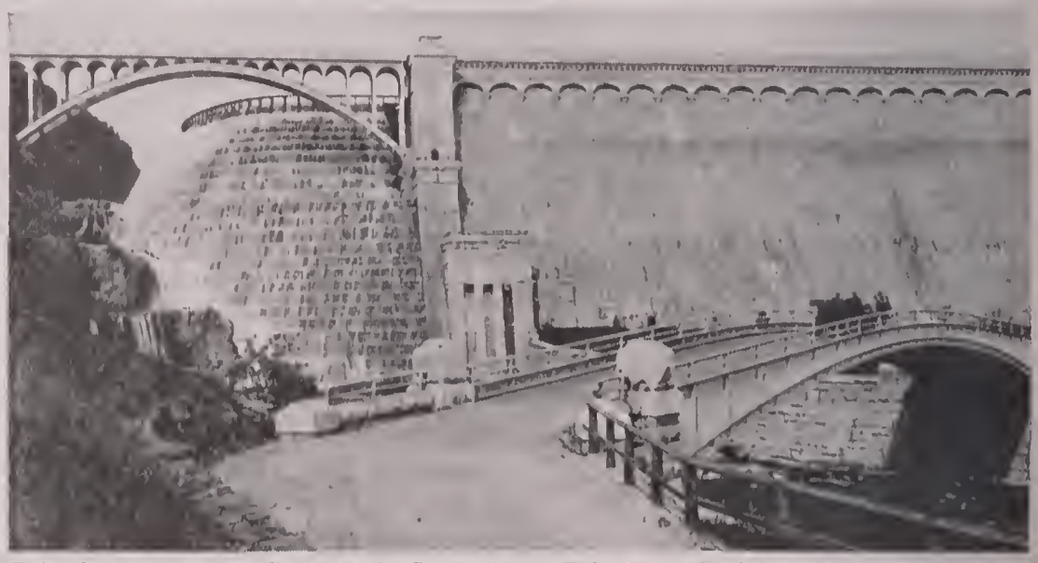
This great body of water, the Ashokan Reservoir, is impounded in the Catskill Mountains for the use of New York City, and furnishes 500,000,000 gallons a day, delivered to the city limits through an aqueduct 92 miles long. Of this, 31 miles was tunnelled through rock, and includes a remarkable stretch 1,100 feet below the surface of the Hudson River. The aqueduct is also carried beneath the Croton Reservoir, so that water from it may be delivered through the Croton system when desired. The view shows the dam dividing the Ashokan Reservoir into two parts. The division is made so that if water in one part becomes impure, the other can be used while the first is cleaned up.

valleys, and grapes flourish along the Erie shore. The metropolitan markets—particularly New York City, with its demand for every conceivable luxury—have much influence in diversifying New York crops. Thus Long Island has large market gardens; whole communities on the Hudson grow violets for the New York City markets; and milk trains run into New York City daily even from the St. Lawrence River counties, 300 miles away.

The early history of New Netherlands—or New York, as it was called when it passed from the Dutch to the English—foreshadowed its destiny. Even in colonial days, the population of Massachusetts was homogeneous while that of New Netherlands was cosmopolitan; and New Amsterdam spoke 16 languages and dialects at a time when it had but a thousand inhabitants. Today the chief gate of immigration, New York State has double the foreign population of any other. Dutch Van Rensselaers and Roosevelts, English Clintons, Scotch Livingstons, German Schuylers—almost every nation under the sun has contributed in greater or lesser measure to make New York the great state that it is today. Population, 10,384,829.

Apparently the first European to enter New York harbor was Giovanni Verrazano, an Italian navigator in the French service, who came in 1524. In 1609 the Englishman Henry Hudson, under commission from the Dutch Netherlands, explored the Hudson River in the *Half-Moon*. In the same year Champlain entered the limits of the state from Canada. The first trading posts, made by the Dutch at Fort Nassau (Albany) and on Manhattan Island, came in 1614. In 1664 the English took forcible possession of the colony and gave it the name of New York, in honor of the Duke of York (the future King James II). In the French and Indian War (1756–63) the loyalty of the Iroquois Indians to the English cause was an important factor in the victory.

WHEN THE "DRINKING CUP" RUNS OVER



This view shows the spillway at the Croton dam. This dam, with its auxiliaries, can impound approximately 100 billion gallons of water, and two aqueducts deliver 372,000,000 gallons a day. Even this great supply, however, is not enough for the metropolis, and the great Catskill project shown above was needed to help out. The dam is 1,168 feet long, 294 feet high from its foundation, and 210 feet above the old river level.

Some of the most stirring scenes of the American Revolution occurred in what is now New York State, notably Burgoyne's surrender. Its central position between the New England and the Southern colonies made it strategically important, and it was the last portion of the old Thirteen Colonies to be evacuated by the British. The admission of the Green Mountain region as the state of Vermont (1791) put an end to a troublesome controversy with New Hampshire over the possession of that territory. By the outbreak of the Civil War, New York had become the Empire State, with a population of nearly 4,000,000, and it has forged ahead ever since. Slavery was abolished in 1817. New York has long been considered a "pivotal state" in presidential elections, and four presidents have been New York men, three of them (Van Buren, Cleveland, and Roosevelt) being ex-governors of New York.

For any subject not found in its alphabetical place see information

TOWER-TOPPED MANHATTAN—
The Metropolis of the Western World

NEW YORK CITY. In size, in wealth, in financial operations, in manufacturing, in foreign commerce, in its motley racial makeup—in a hundred ways—New York is one of the two greatest cities of the world. Its population of more than 5,600,000 exceeds that of any one of half the nations of the earth, and is exceeded by that of London only among the world's great cities. Its yearly expenditure is greater than that of any but seven of the nations of the world. It is the most important manufacturing and business center of the United States, and since the World War it has been the financial center of the globe. Through its unsurpassed harbor, with more than a hundred miles of docks, pass each year imports and exports which exceed in value those of any other port. It is the richest city in the world, with the most luxurious dwellings and hotels; but a walk of ten minutes from its financial and shopping centers will take you to haunts of the extremest poverty and misery, the crowded tenement house districts and foreign settlements of the East Side.

In the middle of the upper bay of New York, which lies south of the city, is Bedloe's or Liberty Island. On this stands Bartholdi's far-famed statue of 'Liberty Enlightening the World', given by the people of France to the United States in 1886. Holding her bronze torch 300 feet in the air, this statue dominates the entire bay, greeting traveler and immigrant. If you climb up the 350 steps to the head of this colossus—which is so large that 40 persons can stand in it comfortably—you will see the entire harbor and surrounding lands of New York spread out below you. You behold a bay swarming with shipping from the ends of the earth and woven with flying shuttles of ferry boats; islands and mainland bristling for miles with docks and slips, the tangle of waterways between them arched high with massive bridges; and the awe-inspiring skyline of New York looming rugged and dark against a clear blue background. This is—

She that sits by the sea, new-crowned with a fivefold tiara;
She of the great twin harbors, our lady of rivers and islands;
Tower-topped Manhattan,
With feet reeded round with the masts of the five great oceans,
Flowering the flags of all nations, flaunting and furling,—
City of ironways, city of ferries,
Sea-Queen and Earth-Queen!—*Richard Hovey.*

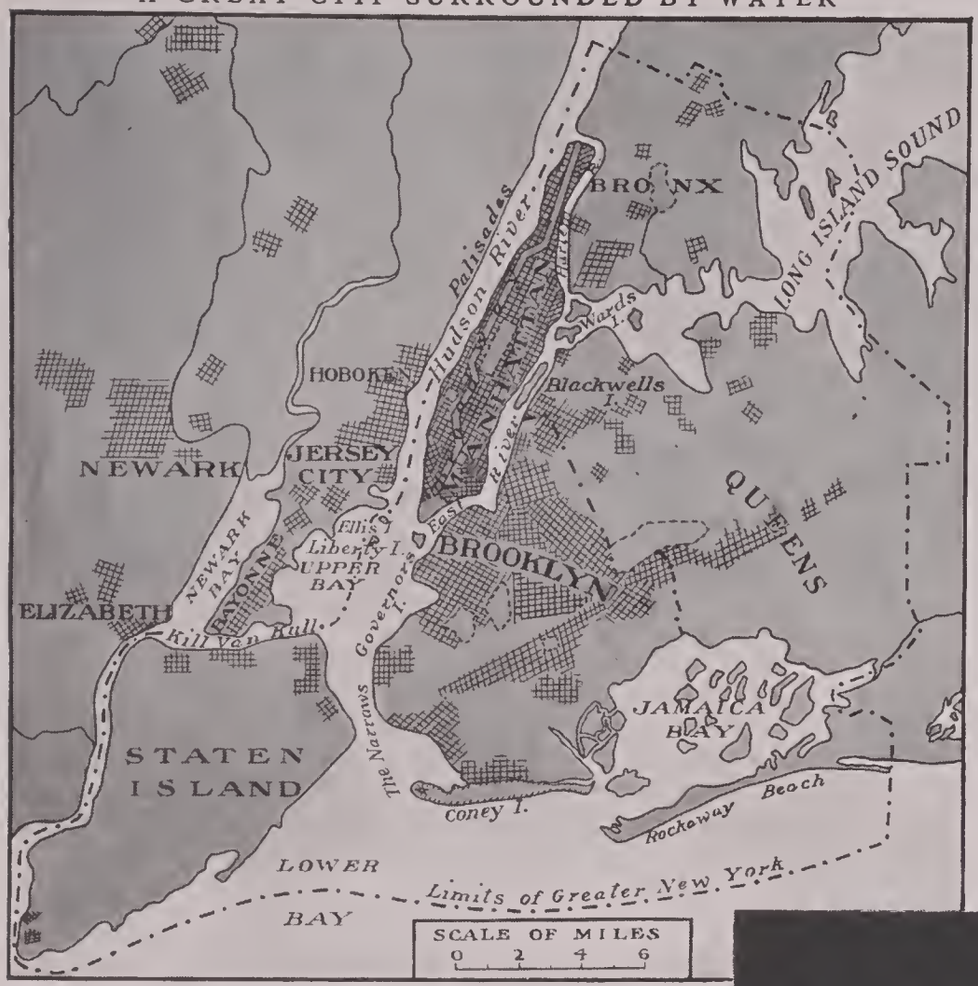
Looking northeast you see the tip of the tongue-shaped island of Manhattan, the heart of New York, crowded with tall buildings. On each side of Manhattan are wide rivers swarming with ships, ferry boats, and launches. The river that skirts it on the west is Hudson River, still called in its lower course "North River" by New Yorkers to distinguish it from the Delaware, the "South River" of Old Colonial days (*see* Hudson River). On its western shore lies New Jersey, with its great cities of Jersey City and Hoboken. These cities are natural parts of the giant metropolis, but cannot be annexed because they lie in another state.

The winding "East River," on the other side of Manhattan, is crossed by several great bridges. This body of water also seems inappropriately named, since it is really not a river at all, but an arm of the sea

NEW YORK CITY HAS

More than 5,600,000 people, of whom nearly 2,000,000 are foreign born.
It has more Italians than Rome, more Irish than Dublin, more Germans than Bremen, and one-tenth of all the Jews in the world.
More telephones than London, Paris, Berlin, Petrograd, and Rome combined.
Five of the largest bridges in the world, each more than a mile long.
More than 60 daily newspapers.
More than 2,000 theaters and photoplay houses.
More than 1,500 churches of all denominations.
Taxable property valued at about $8,500,000,000.
About 300,000 visitors a day.
A passenger train arriving every 52 seconds.
A wedding every 13 minutes, and a birth every 6 minutes.
A new business firm starting up every 10 minutes.
A new building erected every 51 minutes.
An underground aqueduct big enough to carry drinking water for the whole world.
Grand Central Station, covering 79 acres of ground, which can accommodate 30,000 at a time without crowding.

A GREAT CITY SURROUNDED BY WATER



Looking down on this map, imagine the criss-crosses are masses of buildings; that busy ships are plying those waters; and above all, think of the wonder of that little island of Manhattan, with an average of more than 100,000 people on every square mile! In the middle of the Upper Bay is Liberty Island, on which stands Bartholdi's Statue of Liberty, holding her torch 300 feet in the air to greet the home-coming traveler and the immigrant sighting the Promised Land.

about three-quarters of a mile wide, a continuation of Long Island Sound. Since the blasting of rocks in this channel at Hell Gate, in 1885, this entrance to the harbor has been used by coasting vessels. In East River are three large islands—Blackwell's, Ward's, and Randall's—that are occupied chiefly by prisons and other municipal institutions of Greater New York.

On the other side of East River is Long Island, whose populous boroughs of Brooklyn and Queens are part of New York City (*see* Long Island). They furnish thousands of commuters to Manhattan Island every day, and have many great industries of their own. If Brooklyn still had its former separate government, it would be the third city in the United States (*see* Brooklyn).

Now look south toward the neck of the pear-shaped bay, the mile-wide channel called the "Narrows," which connects the Upper Bay and the Lower Bay. East of it is Long Island, and on the west are the beautiful wooded slopes of Staten Island (Richmond Borough), a pretty but as yet comparatively little populated suburb of New York. Between it and Manhattan Island ferries are constantly plying back and forth. If it is a clear day you can see beyond the Narrows to the Lower Bay, into which the long narrow sandspit known as Sandy Hook projects northward from New Jersey.

Returning in the ferry from Bedloe's Island to Manhattan, you will pass Ellis Island, used by the Federal government as a landing place for immigrants. In normal years more than a million people are landed and inspected here before being admitted to America. At the entrance to East River you will also get a glimpse of Governor's Island, which is occupied by the Federal government for military purposes; and then in a few minutes you arrive at the "Battery," the southern tip of Manhattan. Battery Park (21 acres) occupies the site of the old Dutch fortifications. The round fort, which was long famous as a public assembly hall under the name of Castle Garden, is now an aquarium with one of the world's best collections.

Manhattan Island is only from 1 to $2\frac{1}{2}$ miles wide and $13\frac{1}{2}$ miles long. Until 1874 the city did not extend beyond its limits. A good pedestrian could walk across it in 30 minutes, and he could walk its length, from the Battery up Broadway to the Harlem River, in half a day. The island covers only 22 square miles — one-fifteenth the area of Greater New York; but more than one-third of New York's total population is crowded in this small space. On the average square mile there are more than 100,000 people, as many as in the state of Nevada; and the lower East Side, below Fourteenth Street and east of Broadway, is one of the most densely populated spots in the world. To Manhattan's resident population must be added the throngs of strangers normally there—four of whom, it is said, arrive every second; and in the daytime this number is swelled another million by those who work in the city but sleep in outlying districts and suburbs from 5 to 50 miles away.

To accommodate this immense working population, the business sections have been covered with towering structures, many of which house as many people as a small city. By the invention of the steel skeleton type of construction (*see* Building Construction) a generation ago, it was made possible to carry these buildings 20, 30, 40, and even 50 stories into the air; while their enormous weight is sustained on piers sunk to bed-rock, sometimes 100 feet below the surface. The Woolworth Building, with its 51 stories, is 785 feet above the sidewalk, the highest work of man in the world with the exception of Eiffel Tower, and the most beautiful structure ever erected for commercial purposes. In lower New York the streets are lined with these giant skyscrapers, which form shadowy canyons stretching in every direction. They seem destined to spread over "uptown" also, for even in Harlem (the northeastern part of Manhattan Island) there are huge apartment houses.

THE WOOLWORTH BUILDING AT NIGHT

This is the Woolworth Building seen by night from behind the pillars in the façade of the Municipal Building. Towering 51 stories up into the air, it seems like some wild dream rather than the actual work of man's hands!

"Keep your woods, O Nature, and the quiet places by the woods," sang Walt Whitman; "give me the streets of Manhattan!" Though some would disagree with him, the streets of Manhattan are indeed wonderful. There is Wall Street, once the site of the Dutch wall across the island, and now the financial center of the world; its name is synonymous with stocks and bonds, investment, speculation, sudden fortune, and no less sudden ruin. An extremely narrow thoroughfare, hardly half a mile long, it has an importance altogether disproportionate to its size. At the head of Wall Street, in the midst of the banks and great office buildings and just beyond the roar of the curb market on Broad Street, stands Trinity Church with its old graveyard. A noble Gothic building (erected in 1846 on the site of the original church built in 1698), it keeps its beauty and dignity in spite of the great office buildings which loom far above its spire and dwarf its proportions. Half a mile to the north another tiny but famous street runs east from Broadway, the historic Park Row, home of several great newspapers.

BUSY LIFE ALONG THE WATER

On the left we see the broad harbor mouth of the Hudson, lined with docks, and below, two of New York's famous bridges over the East River, the Brooklyn bridge at the right and the Manhattan bridge.

At the lower end of the island the streets are tangled and narrow, for they are "left over" from the old town of colonial days. Above Washington Square, about two and one-half miles north of the Battery, the street system simplifies into the regular "gridiron" form of streets crossing at right angles. The north-and-south streets are called "avenues," and most of them are numbered. The east-and-west thoroughfares are called "streets" and numbered from south to north. Unlike most American cities, the blocks are solid and have no alleys.

Broadway, "the greatest street in the world," runs diagonally north through the island from the Battery up to the Harlem River and beyond, and changes its character a half-dozen times in as many miles. In the lower part of the city it is strangely narrow, but contains some of the most famous buildings in New York. Trinity Church is on this street, as well as St. Paul's Chapel, a cherished relic of colonial days. Near Trinity is the Equitable Assurance Building, the largest office structure ever built, which takes care of some 15,000 tenants; and also the Singer Building, as noteworthy for beauty as for height, which for a few months enjoyed the honor of being the loftiest in the city, only to lose it to the Metropolitan and later to the Woolworth.

Above Chambers Street, near which cluster a magnificent group of municipal buildings—the old white marble City Hall, built in 1812, the new 24-story Municipal Building, the superb Criminal Courts Building with the frowning "Tombs" Prison adjacent and the Hall of Records—the towering temples of finance give way to the less imposing structures of the great wholesale trade section. At Tenth Street, marked by the ornate Gothic structure of Grace Church, Broadway swings to the west and the character of its business also changes. A few blocks above, the retail trade section begins. At Twenty-third Street Broadway crosses Fifth Avenue, with the Flatiron Building at the intersection and Madison Square adjoining. Near the six-cornered crossing of Broadway with Sixth Avenue and Thirty-third Street is

THE MOTLEY THRONGS ON ELLIS ISLAND

Immigrants are landed on Ellis Island, and before going ashore, each has a label attached with information as to his nationality, the ship in which he came, his destination, and so on. Those who are bound for the same place are put together in one of those pens. At the right we see a typical immigrant family carrying all their worldly goods.

one of the busiest sections in the city, the location of many department stores and famous hotels. Above Forty-second Street, where most of the important theaters are located in close proximity, Broadway is known as the "Great White Way," from the thousands of brilliant electric lights arranged in ingenious advertisements which border it.

At Fifty-ninth Street Broadway continues through Columbus Circle, at the southwestern corner of Central Park. Eighth Avenue, which intersects Broadway at this point, continues along the western edge of Central Park under the name of Central Park West. A series of magnificent apartment houses facing the Park occupies its entire length. At Eightieth Street the diagonal course of Broadway has brought it within two blocks of the Hudson, and from this point it continues in a course generally parallel with the river. From 116th Street for several blocks it skirts the grounds of Columbia University (established as King's College in 1756), whose campus, extending from Riverside Drive along the Hudson to Morningside Park, has been called "the Acropolis of America." Near by, facing Morningside Park, is the Protestant Episcopal Cathedral of St. John the Divine, which was begun in 1892 and is intended to be the most costly and magnificent church structure in America. From there on Broadway loses some of its interest, but continues across the Harlem River and into the city of Yonkers, forming one of the longest continuous streets in the world.

Very different from Broadway, but no less famed, is Fifth Avenue, New York's most beautiful thoroughfare. Beginning with Washington Arch at Washington Square, about a quarter of a mile west of Broadway at this point, it extends north for six miles, lined with fashionable shops, churches, clubs, hotels, and costly residences. Among the notable buildings is the Public Library at Forty-second Street, a palatial structure which houses two and a half million volumes and pamphlets; the collections include the priceless rarities of the Lenox Library and the old Astor

A LITTLE TOUR AMONG THE MANY FASCINATING

The Aquarium, Battery Park

Park Row, Looking North toward the Municipal Building

Wall Street — Trinity Church at End of Street

City Hall

Fifth Avenue at Fortieth Street

Times Square and the Times Building

At the southern tip of Manhattan Island is Battery Park, with its famous Aquarium. A short distance north, where Park Row branches off from Broadway, is the Post Office, with City Hall Square and the City Hall immediately behind it. As you glance up Park Row, you see the shedlike approach to the Brooklyn Bridge and the tall Municipal Building. New York's most famous cross-town thoroughfare is Wall Street. The picture here shows the view down Wall Street, to where Trinity Church marks its junction with Broadway. Further uptown Broadway, now running somewhat northwest, crosses Fifth Avenue. If you take one of the famous Fifth Avenue busses, get off at Forty-second street, and walk a few blocks west, you come again to Broadway at Times Square.

For any subject not found in its alphabetical place see information

SCENES OF NORTH AMERICA'S GREAT METROPOLIS

The "Gay White Way" at Night—Broadway North from Forty-Second Street

Cleopatra's Needle, Central Park

Columbus Circle—Lower West Entrance to Central Park

Metropolitan Museum of Art, Central Park

Grant's Tomb, Riverside Drive

The district along Broadway north of Times Square is the theatrical center of New York, known the world over as "the Gay White Way" from its brilliant lighting. At Fifty-ninth Street, Broadway, still running diagonally, strikes Columbus Circle. The Circle is at the southwestern entrance to Central Park, New York's great playground. You now have a choice of two routes over which to finish your little tour. You can go through the Park, with its many objects of interest, including the Egyptian obelisk, known as "Cleopatra's Needle" and the Metropolitan Museum; or you can follow Broadway to Seventy-second street, then go a few blocks west and north overlooking the Hudson, along Riverside Drive. This route will take you past many wonderful apartment buildings and Grant's Tomb.

contained in the Easy Reference Fact-Index at the end of this work

WHERE THE CHILDREN COME TO PLAY

Library, which together with the Tilden Foundation are now incorporated in the Public Library. The beautiful St. Patrick's Cathedral is at Fifty-first Street, and St. Thomas' Church at Fifty-third. North of Fifty-ninth Street, where Fifth Avenue forms the eastern boundary of Central Park, there are probably more millionaire residences than on any other thoroughfare in the world.

Other interesting New York streets are Morningside Drive, a beautiful avenue along a high bluff; and Riverside Drive, a broad tree-shaded boulevard lined with extravagantly luxurious apartment buildings on the east side, looking across the Hudson River to the Palisades, the beautiful green cliffs of the New Jersey shore. At 122d Street this drive widens out to enclose Grant's tomb, its chief point of interest.

Near Washington Square is the quaint old Greenwich Village district—New York's "Latin Quarter"—which prides itself upon its bohemianism and its art. Like the rest of lower New York, it is a maze of short crooked streets. The famous Bowery, a curving avenue roughly parallel with Broadway, is one of the chief thoroughfares of the cosmopolitan East Side. With its teeming tenements and little shops it retains little to remind one of the orchard and farm (*bowerij*) of old Gov. Peter Stuyvesant which gave it its name.

New York has many breathing spaces for its congested population. Directly in the center of Manhattan is Central Park. In it on the Fifth Avenue side is the Metropolitan Museum of Art, the largest and richest art museum in America; and west of the park is the American Museum of Natural History. Above the Harlem River, in Bronx Borough, are Van Cortlandt

In the lower of the two pictures, we see one of the fountains in New York's famous Central Park—more than 800 acres right in the heart of the city. In the southwestern part of the park is a playground for children with swings, trapezes, slides, and so on. Over in the southeastern part, you go to ride the big humped camel, feed the elephants peanuts, watch the sea-lions dive, and all the other fascinating things you can see and do at the "Zoo." The upper picture shows the Old Bell Tower, a relic of Revolutionary days, in Mt. Morris Park, north of Central Park.

For any subject not found in its alphabetical place see information

Park; Bronx Park, noted for its "zoo" and botanical gardens, and Pelham Bay Park, with its eight miles of salt water shore. There are scores of other parks and hundreds of playgrounds. But the greatest crowds go to Coney Island, just south of Long Island and fronting directly on the ocean (*see* Coney Island).

New York a City of Foreign Peoples

Every country of the world and every state of the nation contributes to the population of New York City, which has a comparatively small proportion of native "Gothamites." If every person whose parents were born in America were to leave the city, it would still be the second city in the world; for three-fourths of its people were born in foreign countries or are the children of foreign-born. There are many well-defined foreign communities in the city, such as "Little Italy," "Chinatown," and Jewish, German, French, Russian, Greek, negro, and Armenian quarters. Not only does each nationality tend to hold together by itself, but Sicilians flock together apart from other Italians, and whole blocks are inhabited exclusively by immigrants from this or that Sicilian town or village. In such districts the Old World customs are preserved little changed and the task of Americanization is made very difficult.

It is a huge task to replace the 70 or more tongues of New York's immigrants by English and fit the boys and girls for useful places in the community; and if it were not that New York is so rich—with assessed values greater than those of the next seven cities in America combined—it would be hopeless to attempt the task. Of the hundreds of million dollars which New York spends every year to carry on its government, about one-fifth is used to educate the 900,000 pupils who receive instruction in the public schools of the city. In addition to the municipally supported College of the City of New York at 138th Street near the Hudson River, New York has two of the larger universities of the United States—Columbia University with its two affiliated colleges, Teachers' College and Barnard College (for women); and New York University, in the Bronx, where the Hall of Fame is located (*see* Hall of Fame).

The greatest problems which have confronted New York are those of water supply and transportation. The former was solved by the building of the 119-mile Catskill Aqueduct, one of the most stupendous engineering projects ever completed (*see* Aqueduct).

FOR NEW YORKERS WHO LIVE IN "JERSEY"

Thousands of people whose business is in New York City live in New Jersey, just across the Hudson. These "New Jersey-New Yorkers" come and go over the river on these ferry boats, or go by train under the river through the tunnels known as the "Hudson tubes." In one year these ferries carry nearly as many passengers as there are people in the whole United States, while the tubes carry about three-fourths as many.

New York is still struggling with its transportation problem, for every day twice as many people have to be transported in Greater New York as are moved by all the steam railroads in the whole United States.

In order to cope with the situation New York has built up the greatest system of urban transportation in the world. On Manhattan itself, in addition to the surface lines, which run on nearly every north-and-south avenue, there are four parallel lines of elevated railroad tracks, besides the "subways"—one line running northward under Broadway, and another under Lexington Avenue on the East Side. Both continue through tunnels under the East River to Brooklyn.

Five bridges cross the East River, towering high above the water's level to permit the passage of ocean steamers—the Brooklyn, Williamsburg, Queensboro, Manhattan, and Hell Gate bridges, the last having the longest arch in existence. Even this aggregation of immense bridges is wholly unequal to caring for the armies of people who travel daily between Manhattan and Long Island. Several tunnels have therefore been built under the river, and others are being constructed. New Jersey, too, is connected with Manhattan by "tubes," so that one may travel by means of these and the subways from Jersey City to Brooklyn Heights without glimpsing daylight. Swarms of ferry

THE PENNSYLVANIA STATION IN NEW YORK CITY

We see here, in this station of the Pennsylvania Railroad in New York City, how beautiful and impressive a railway station may be. It has some of the features of a Greek temple; and Mercury, the god of commerce and swift travel, might well accept it for his own. This is one of the largest stations in the world. The lines which feed it pass under the Hudson and the East rivers.

boats also dart back and forth across the East and North rivers, connecting Manhattan with Brooklyn, Staten Island, Hoboken, and other points.

The harbor of New York is connected with the rest of the country by several trunk-line railroads, most of which have terminals on the New Jersey shore. Two stations, however, the Pennsylvania and the Grand Central, are in the heart of Manhattan. Each of these cost considerably more than $100,000,000, and ranks among the city's finest architectural achievements. The Pennsylvania lines reach the Manhattan terminal by tubes under the Hudson.

Now the World's Greatest Money Center

The commercial supremacy of New York is due to its central location on the seaboard and especially to its great port, one of the largest and best in the world, which lies at the entrance to the fine natural waterway of the Hudson and Mohawk valley. Through this harbor passes almost half the foreign commerce of the United States. In one year the exports had a greater value than the combined exports of Asia, Africa, and Australia, and the imports exceeded those of South America, Africa, and Australia together. New York is also the financial center of the world, with banking transactions amounting each year to almost $200,000,000,000. Here are the country's most important "exchanges," including the Stock Exchange, the "Curb," and the Cotton Exchange, as well as the most powerful banks and trust companies and the great New York Clearing House.

New York's financial and commercial interests are on so enormous a scale that they overshadow its great manufacturing industries. But nearly 10 per cent of the manufactured goods of the nation are produced in New York City—almost as much as in Chicago, Philadelphia, Cleveland, and St. Louis together—and almost 90 per cent of the industries of the entire country are represented there. In addition to its commercial advantages, New York is but a short distance from the coal and oil of the Appalachian fields, and is further aided by a large supply of immigrant labor. This last factor accounts largely for its supremacy in the manufacture of men's and women's clothing. Over half the clothing worn in the country is made in New York City. The printing and publishing industry is largely concentrated in New York, and holds second place in value. Meat packing and the refining of sugar come next in importance, and are followed by foundry and machine-shop products, tobacco, millinery and lace, drugs, paints, boots and shoes, musical instruments, and countless other products.

The Dutch West India Company occupied the site of New York with a fur trading post in 1614, five years after Henry Hudson's voyage up the river. For the whole of Manhattan Island the Dutch in 1626 paid the Indians only $24, in beads, brass ornaments, and bright cloths—a sum that today would scarcely buy a square foot of it. The name New Amsterdam was adopted, and by 1640 the shores of Brooklyn, Jersey City, and Staten Island also were occupied.

For any subject not found in its alphabetical place see information

Peter Stuyvesant, the choleric but able governor from 1647 until the English conquest in 1664, is the most interesting figure of the Dutch days. He stumps through the history of the period with his wooden leg —a memorial of his service in Netherlands' West Indian wars—conquering the Swedish colonies on the Delaware, browbeating the Dutch settlers who clamored for greater self-government, telling them, "We derive our authority from God and the Company, and not from a few ignorant subjects," and resisting the growing pressure from claims of the New England colonies and the jealous English government at home.

In 1664 an English fleet sent by the Duke of York (afterwards James II) captured New Amsterdam, and the name of the town and of the colony was changed to New York in the duke's honor. But for many years the city retained its Dutch character, together with a wide use of the Dutch language and customs. Many Dutch names are still in use.

The fall of tyrannical James II in England and the expulsion of his representative Sir Edmund Andros from the colonies, gave rise in New York City to a democratic uprising under Jacob Leisler (1689–91), which ended in Leisler's execution. In 1712 there was an insurrection of negro slaves, and in 1741 a bloody panic due to this same cause, which resembles the Massachusetts witch persecutions of 1692. In 1734 Peter Zenger, the publisher of a newspaper, successfully resisted an arbitrary libel suit, and so established liberty of the press for the colonists.

TWO OF NEW YORK'S GREAT COLLEGES

The upper of these two pictures is a view in the grounds of the College of the City of New York, popularly known as the "City College," while the lower picture shows us a group of buildings of Columbia University. Columbia, which was founded in 1756, was then called "King's College," but changed its name after the Revolution.

contained in the Easy Reference Fact-Index at the end of this work

SWIFT TRAVEL UNDER THE GROUND

Miles upon miles of these subway tunnels bore their way beneath New York City, and swift electric trains dash through them in never-ending streams, whisking their passengers along far faster than any cars could run through the streets above. This subway system has done much to relieve the traffic congestion of New York, as well as to save time for the people in traversing the long stretches of the city.

New York City was prominent in the movement which led to American independence. The Stamp Act Congress (1765) met here, and organizations of Sons of Liberty opposed by violence the sale of stamps, as well as later shipments of tea. The city was occupied by the British armies during the whole of the war, and was a chief refuge for Loyalists. Before the Revolution New York was outranked by both Boston and Philadelphia in commerce; but after the British evacuation (Nov. 25, 1783) New York forged rapidly to the front. Trade with China was begun, and by 1788 a hundred vessels or more might be seen in port at the same time. The opening of the Erie Canal in 1825 improved its westward outlet for goods and definitely insured New York's commercial supremacy. A great fire Dec. 16–19, 1835, destroyed the entire East Side below Wall Street.

New York was the capital of the colony and state until 1797, and in 1789–90 it was also the capital of the Federal government under the new Constitution. In the Civil War the mayor, Fernando Wood, was a Southern sympathizer; and while the city sent large numbers of its native and foreign-born citizens to swell the Union ranks, the disloyal and rowdy element in 1863 caused disgraceful "draft riots," in which $2,000,000 worth of property was destroyed and 1,200 rioters slain. In 1863–71 the notorious "Tweed ring," by its hold on the political organization known as Tammany Hall, controlled and corruptly plundered the city government, until its head, William M. Tweed, was sent to die in a convict's cell.

New York City today is really a federation of cities, for until 1898 its limits included only Manhattan Island, with some territory north of the Harlem River. In that year Greater New York was formed, including the present five "boroughs": (1) Manhattan Borough; (2) Bronx Borough, north of the Harlem River; (3) Kings Borough on Long Island, including Brooklyn, then the fourth city of the United States in size; (4) Queens Borough, including Long Island City, Flushing, Jamaica, and other towns east of Brooklyn on Long Island; and (5) Richmond Borough, or Staten Island. The boroughs retain considerable power over local affairs, exercised chiefly through their borough presidents and the 25 local improvement boards. The borough presidents, elected in each borough, control such matters as grading and paving streets, sewers, and some of the public buildings. Chief executive power for the whole city is exercised by the mayor, who appoints the heads of 16 of the 17 administrative departments and may, with a few exceptions, remove them at will. Power is thus centralized in his hands. The comptroller or head of the department of finance is elected by popular vote. Chief legislative power is vested in a board of aldermen elected from the 70 odd districts into which the whole city is divided. The borough presidents also are members of this board. Control of the harbor of New York is much complicated by the fact that part lies in New York State and part in New Jersey, and in addition the Federal government alone has authority over questions of interstate commerce.

NEW ZEALAND, DOMINION OF. It was a hardy Dutch seafarer, Abel Jansen Tasman, who found these islands in 1642 and gave the land the name it bears today. But no white man seems to have visited New Zealand from that time until 1769, when Capt. James Cook, the famous English navigator, visited them and explored the coasts and the dividing strait which bears his name.

A MAORI CHIEF

The Maoris have always been famous for their tattooing, which was carried out with elaborate patterns, varying with the rank and family of the wearer. This fierce-looking fellow with his feather cloak was probably a great chief.

During the next 60 years whaling vessels and trading schooners seeking timber came to New Zealand. The first settlement, by missionaries, was made in 1814. The Maori inhabitants, although they were an intelligent race, tall, strong, courageous, and resourceful, were addicted to cannibalism and to inter-tribal warfare. At various times they turned upon the white settlers with fury, and the bloody conflict did not cease until 1870. The Maoris of today are law-abiding, peaceful, and intelligent, though indolent. Some of them have risen to important governmental positions.

A MAORI HOME WITH ITS WOODEN IMAGE

Now that the Maoris have been civilized, they are mostly Christians. But many of them retain about their houses images of their old gods, for whom they still keep a certain respect. One of the curious old beliefs of the Maoris was that the human soul was situated in the left eye.

The group of islands which make up the Dominion of New Zealand is in the South Pacific about 1,300 miles southeast of Australia. They are regions of strange and beautiful contrasts. The North Island, a moist semi-tropical region in its upper portion, is filled with amazing geological wonders. Coneshaped volcanoes rise abruptly from its eastern plains, and toward the center is a region of geysers, hot springs, and vast crevices where boiling mud bubbles up from subterranean furnaces. A number of clear mountain lakes of considerable size make dashes of blue in the rough-hewn scenery. The largest is Lake Taupo, 22 miles long.

South Island is even more rugged and magnificent. In the southwest the coast is broken by narrow picturesque fiords, where the sea worms its way far inland between cloud-capped peaks. Stern chains of mountains, the main range of which is appropriately called the Southern Alps, stretch from end to end of the long narrow island. On their western slopes these mountains are covered with forests, on the east with scrub and tussock grass.

A MAORI MOTHER

Women formerly played an important part in the tribal affairs of the Maoris. Sometimes they went to battle with the men, fighting fiercely by their side. At home, however, they were affectionate mothers, even in early savage days.

New Zealand's trees are its crowning glory. Graceful ferns, 20 or 30 feet high, lean above the edge of ravines; and the nikau palm is abundant, whose fronds shoot up from the trunk at so sharp an angle that the wild parrot must hang head downward from the leaves to gorge upon its scarlet fruit. Nearly every tree bears a creeper or a parasite like the deadly rata, which chokes and smothers the life upon which it feeds.

The lordliest tree of the forest is the kauri, rather squat with a trunk often 12 feet thick. Up in the slender neck of North Island the whole countryside has been turned upside down by "gum-diggers" who scrape away the soil seeking the valuable half-fossilized kauri resin, dropped there by ancient forests and used today for making varnish and linoleum.

New Zealand's chief industry is sheep-raising. Wool, skins, and frozen mutton are the principal exports. Some beef and pork are also shipped to Great Britain, together with cheese and other dairy products. Agriculture is constantly growing in importance under the influence of the favorable climate. Large areas have been sowed with English grasses to serve as pasturage for

HOW DUNEDIN WAS MADE TO ORDER

All you have to do is to imagine the green of those tree-lined streets, and to picture the head of an inlet of the blue sea in the distance, and you have one of the most beautiful cities in the world. Dunedin, New Zealand, is one of the few cities that was, so to speak, "made to order." The site was chosen because of its harbor. Then the city was carefully planned and laid out to combine convenience and beauty.

live stock. Gold mining has been an important industry since 1857, and the islands contain also important deposits of silver, copper, iron, lead, zinc, and antimony. Petroleum and coal are produced for local use. Sugar-refining and ship-building give employment to many laborers in the north.

Animal Life on the Islands

Except the descendants of the domestic animals brought in by the Maoris, there were no land mammals in New Zealand when white men landed. Nor are there today any snakes or important poisonous insects. Rabbits were introduced and in a short time numbered millions and did such damage to vegetation as to threaten stock grazing. Only after a long fight supported by government aid was the danger under control. Among the birds, the most noteworthy are the *kea* or sheep-killing parrot, the albatross, and the penguin. Oysters are found in abundance along the coasts, together with a particularly palatable fish known as the snapper.

The government of New Zealand is noted for the many advanced ideas it has put in force. The state conducts many enterprises for the benefit of the citizens, such as life and accident insurance bureaus, an old age pension system, and loan banks for the benefit of settlers. Labor disputes must be settled by a compulsory arbitration court. The railroads are owned by the government, together with the coal mines which supply their fuel.

New Zealand is a British colonial Dominion, and includes, besides North and South Islands and Stewart Island, other remote groups chief of which are the Chatham Islands to the east, and the Aucklands and Campbell islands to the south. The former German colony in the Samoan Islands is now ruled by New Zealand under a mandate from the League of Nations. On matters affecting Great Britain's international and intercolonial interests, the authorities in Great Britain are consulted; but otherwise the Dominion legislates and governs as it chooses, under a governor-general appointed by the Crown, a legislative council, and a house of representatives.

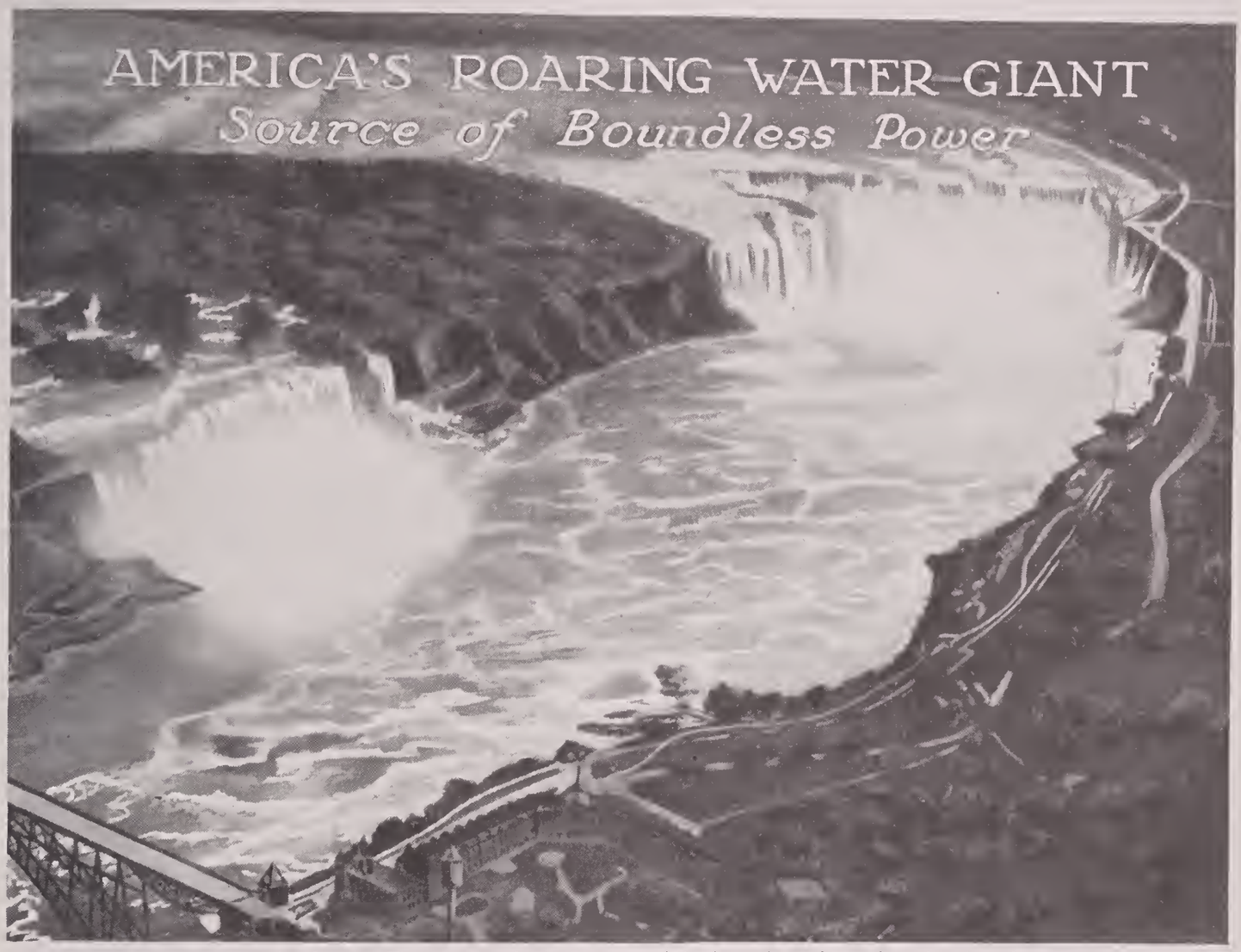
The largest cities of New Zealand are Auckland (145,000), the chief seaport, beautifully situated on Hauraki Gulf to the north; Wellington (101,000), the capital, on Cook Strait; Christchurch (102,000), and Dunedin (73,000), both on South Island.

The main New Zealand group is 1,000 miles long and 180 miles wide at the widest point, with an area of 103,581 square miles, about that of Colorado. Population, about 1,242,000, of which 63,000 are Maoris and Chinese.

Ney (*nā*), Michel (1769–1815). "The bravest of the brave" was the title given by Napoleon to this one of his great marshals. Although of humble birth—the son of a cooper—Ney had become an under-officer in a hussar regiment by the beginning of the French Revolution. When that event opened up the way for advancement, promotion came rapidly as a reward for merit, and at the establishment of the empire in 1804 Ney was made a marshal of France. He was a sincere admirer and staunch supporter of the emperor, contributing to the victory of Jena, and leading the decisive attack at Friedland.

But it was in the Russian campaign that his bravery was most conspicuous. On the disastrous retreat from Moscow he protected the rear, encouraged the soldiers, and was himself the last to cross the Russian frontier. When the news of the escape of this "Launcelot of the Imperial chivalry" reached Napoleon, he exclaimed to his officers: "I have more than 400,000,000 francs in the cellars of the Tuileries and would gladly have given all to ransom my faithful companion in arms."

But a few years later Napoleon in his far-away prison-island, St. Helena, heard without emotion the news that Ney had been shot as a traitor. The reason for this change of attitude was that when Napoleon had been forced to abdicate, in 1814, Ney had gone over to the royalists with loud protestations of devotion to the Bourbons. When Napoleon had returned from Elba, Ney had set out from Paris, boasting that he would bring this disturber of the peace back "in an iron cage," but when he had met his former commander, he and his whole army had joined the force of the enemy, and had fought for Napoleon at Waterloo. It was for this that he had suffered death, and it was because he had broken his faith both with Louis XVIII and with Napoleon that the exiled emperor condemned him as "dishonorable." The legend that Ney escaped to the United States and lived there many years before his death is without any historical authority.



NIAGARA FALLS. Anthony Trollope, the celebrated English novelist, once wrote that "of all the sights on earth which tourists travel to see," he knew of none "so beautiful, so glorious, and so powerful" as the falls of the Niagara River, about 22 miles northwest of Buffalo. Some people differ with him, pointing particularly to the Grand Canyon of the Colorado; and since the discovery of Victoria Falls in South Africa, Niagara Falls no longer can claim the distinction of being the greatest falls in the world, though they are still the second greatest. But certainly in point of scenic splendor they are not only the most sublime of all cascades, but are among the foremost of "all beauties of Nature prepared by the Creator for the delight of his creatures."

Every minute of day and night about 15,000,000 cubic feet, or more than 467,400 tons, of water are leaping, vaulting, catapulting madly over their precipice. Tumbling as it were from the blue of the very heavens, the water avalanches hurl themselves with awe-inspiring fury upon the bowlders more than 158 feet below.

In making their wild plunge, the angry torrents shoot with such might over the ledge that they land 49 or 50 feet forward of it, where they churn themselves into a boiling, seething, swirling cauldron. The fairy-like foam and spray rebound many feet, ladening the air with silvery mist and sparkling in gorgeous rainbows under the sunlight. The ceaseless roar explains the name Niagara, meaning "Thunder of Waters," given by the Iroquois Indians.

In the center of the river Goat Island splits the cataract into two falls, the Canadian, on the left or west side, and the American on the right side. The former, called Horseshoe Fall because of its shape, measures about 3,000 feet on the curve. The American Fall, which is almost straight across, measures about 1,000 feet in length. Though its descent is a few feet greater than that of the Canadian fall, its volume of water is only one-twentieth to one-tenth of the total flow; hence the Canadian fall is much the grander. The depth of water at the crest of the falls varies from 4 to 20 feet.

The falling water has worn the rocks away so that there are caves under the majestic curved sheets of both falls, from which sightseers, clad in waterproofs, obtain a magnificent view. The Canadian fall has excavated a basin as deep as the height of the fall, which temporarily retards the waters and enables a little tourist steamer to poke its nose quite up into the mist. Scenic rail and trolley lines skirt the river.

In winter parts of the great falls are often frozen over; and icicles, far thicker and taller than the pillars in any cathedral, glisten like diamonds in the sunshine.

Scarcely less marvelous than the falls are the river rapids above and below them. The Niagara River, part of the boundary between New York and Ontario, is Lake Erie's outlet into Lake Ontario, 33 miles northward. The level of the latter lake is about 330 feet lower than that of Lake Erie, but for about 20 miles the river makes only a small portion of the descent. Then it narrows from about three miles in width to less than a mile, and in the remaining mile or so above the falls it descends 52 feet, gaining such rapidity as it dashes over its rocky bed that it forms the Upper Rapids, forever lilting, foaming, chopping, bounding.

The Great Rapids and the Whirlpool

Making about half its total descent at the falls, the river enters the picturesque Niagara Gorge—banked by perpendicular walls of rock 200 to 500 feet high—flows a couple of miles farther and then forms the famous Whirlpool Rapids, extending for about a mile and descending about 100 feet. Gnashing and booming their way over huge bowlders at the rate of 30 miles an hour, these rapids are even more savage than those above the falls.

Just below these rapids, the river, making a sharp turn to the left, has worn into the rock a large circular basin. This is the Whirlpool, one of the greatest maelstroms in the world. Here the whirling eddies pursue one another around in circles, lashing the stream into foam and spume. The Whirlpool is viewed from cars swung on an aerial cableway 1,800 feet long. The gorge near the falls is spanned by three bridges, two of them railroad bridges.

Nearly four miles farther on the gorge ends. Ages ago, possibly 35,000 years ago, this terminal slope used to be the cliff over which the fall descended, and there was no gorge. Since then the falls, by gradually eating and wearing away the rocky ledge or crest, have worked their way backward seven miles, digging the gorge as they receded. This is still going on, the edge of the American Fall retreating from two to seven inches a year, and Horseshoe Fall retreating about five feet a year. Since the Civil War the falls have worn back about 335 feet.

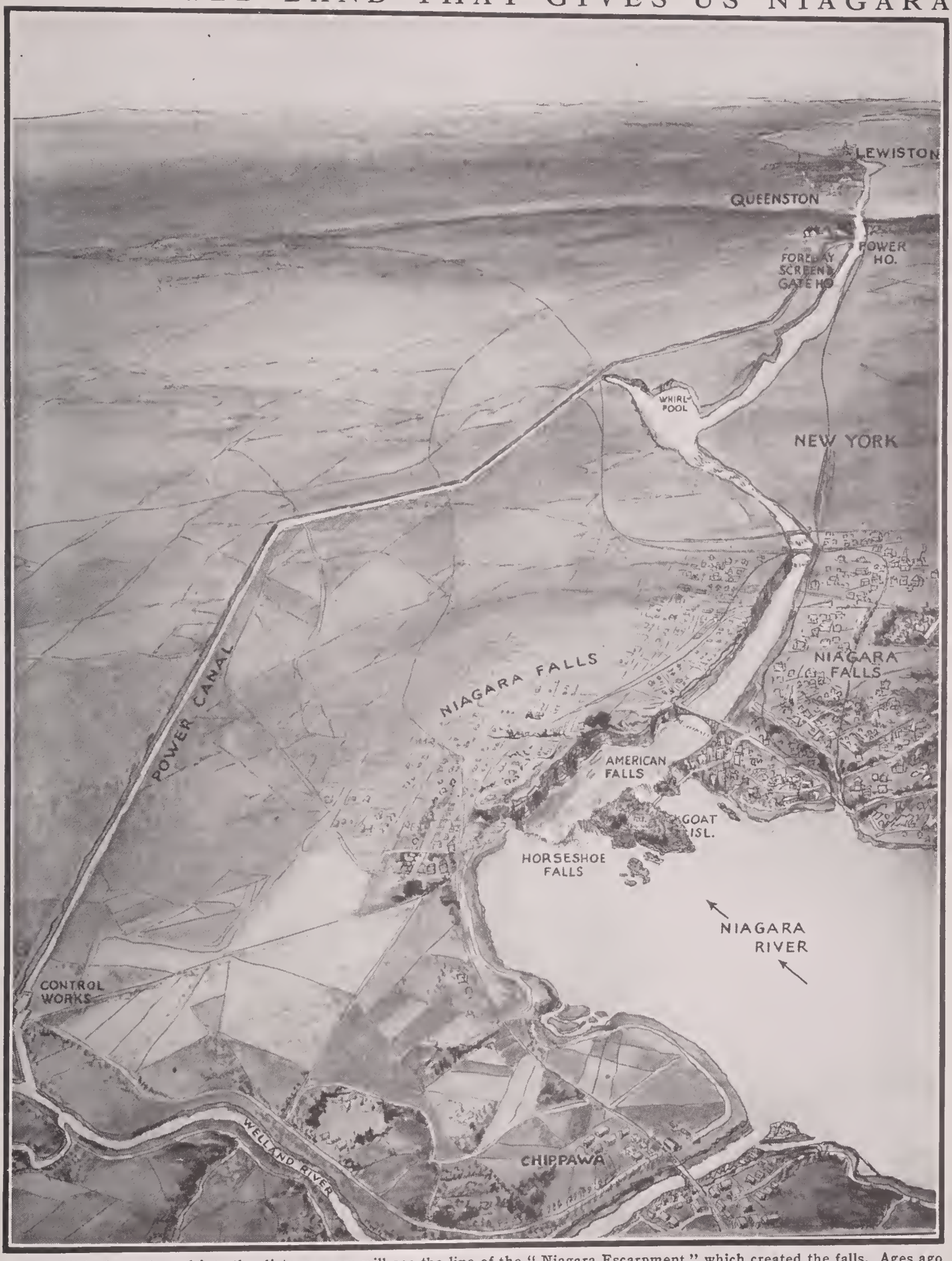
The fascination of the great stream gliding to its plunge or whirled in the rapids has drawn the adventurous to foolhardy exploits. Some have tried to swim the rapids, but newspaper notoriety and death were their only rewards. Others have tried to go over the falls in ingeniously arranged barrels. A certain Captain Webb succeeded in coming out alive. In 1859 Blondin, a French tight-rope walker, crossed over the falls. In one trip he was blindfolded and pushed a wheelbarrow ahead of him on the cable; on another trip he carried a man on his back; and again he crossed on stilts.

Putting the Water Giant to Work

Fractious Niagara is more than a spectacle; it has been made into a benefactor of mankind. One glimpse at it suggests Power; and Power there is. Fed by the mighty reservoirs of the Great Lakes, it pours over its precipice a volume of water great enough to develop over 3,975,000 horse-power—enough to meet nearly one-tenth of the power needs of the United States. If the full drop from lake to lake were used, over 5,000,000 horse-power could be obtained. At present well over 300,000 horse-power has been "harnessed." Water is drawn from above the falls into canals and conducted down to subterranean sluiceways and tunnels, where it flows through gigantic turbine wheels and thence back into the river below the falls. The wheels, spun around by the water at 250 revolutions a minute, are connected by upright shafts with humming dynamos in the long flat power houses along the river banks below the falls. Thus the dynamos generate electrical energy, each developing 5,000 horse-power. This energy is used in large part in nearby industries but is also transmitted to Buffalo and surrounding territory to furnish lights, run streetcars, and operate power plants.

Although little was done toward the "harnessing of Niagara" until the invention of the dynamo and the transmission of energy by electric wire, the building of power houses and factories soon thereafter threatened to destroy the falls as a spectacle by the withdrawal of water above the brink. An appreciable difference in the volume of the cataract already had been made when in 1910 the governments of the United States and Canada made provision for restricting the water used for industrial purposes to

THE TILTED LAND THAT GIVES US NIAGARA



If you will look northward into the distance, you will see the line of the " Niagara Escarpment " which created the falls. Ages ago Dame Nature broke the land in two along an east and west line, and pushed the southern portion up, so that now a great cliff frowns down upon the land between Queenston and Lake Ontario. At first the waters from Lake Erie poured over this cliff near Queenston; but gradually they wore the rock back, until they brought the falls to their present position. The power canal is a recent project of Canadian enterprise, and is designed to furnish 300,000 horse-power, in addition to that already developed in the immediate vicinity of the falls.

contained in the Easy Reference Fact-Index at the end of this work

20,000 cubic feet a second on the American side, and 36,000 cubic feet a second on the Canadian side.

On each side of the falls is a beautiful park and a town. On the American side is the 107-acre New York Park, under the New York state government; and Niagara Falls, N.Y., one of the centers of the electrochemical industries of the world, which owes its growth chiefly to the harnessing of Niagara (population, about 51,000). On the Canadian side is the 154-acre Queen Victoria Niagara Falls Park under the Canadian government; and Niagara Falls, Ont., a railway center (population, about 13,000). (*See also* Welland Canal.)

NIBELUNGS (*nē'bē-lungs*), SONG OF THE. Long ago in the Middle Ages, when frowning castles crowned the hilltops of the Rhineland, wandering minstrels roamed through the country. With song and story they gained entrance to formidable fortresses which had never opened their gates under the onslaughts of enemy hordes. Gathered around a crackling fire of great logs, the warrior lords and their followers would listen for hours to the lays of the minstrels. The tales of a mythical German race called the Nibelungs was a favorite theme for song, and glorious were the deeds of the gods and warriors of whom the minstrels sang. Later on these lays were written out and collected into a book called the Nibelungenlied, or 'Song of the Nibelungs', and on this collection have been founded many famous works. Some of Wagner's stirring operas were taken from this source.

Once upon a time, one of the older versions states, three gods, Odin, Loki, and Hoener, visited the earth and while wandering near a stream saw an otter devouring a salmon. They killed and skinned the otter and bearing the pelt with them sought shelter for the night in the abode of Rodmar, a greedy heartless miser. Rodmar recognized the pelt as being that of one of his sons, who had the power of changing his shape. He demanded as pay (wergeld) for the slaying of his son enough gold to completely cover the otter pelt. To get the gold the gods hastened to the river and seized a priceless treasure which was guarded by a giant fish, but when all was heaped upon the pelt one hair remained uncovered. Yielding to Rodmar's demand, Loki placed on this a ring which bore this curse: "Evil shall come to him who wears it." This treasure passed after a time into the hands of the Nibelung kings, and played its tragic part in the 'Nibelungenlied'.

In the Song of the Nibelungs this hoard is found in the possession of Siegfried, a daring warrior, who has slain the two kings of the Nibelungs to obtain it. Little mention is made of the curse, and the story deals chiefly with the adventures and loves of humans, the gods having altogether disappeared from the scene. The plot centers around Kriemhild, the beautiful sister of Gunther, king of the Burgundians, who holds his court at Worms, on the middle Rhine. Siegfried comes to Worms to woo Kriemhild, and in due course they are wedded.

Many characters are introduced into the story, one being Brunhild, an Icelandic princess of wonderful beauty and warlike strength. Only he who should overcome her in deeds of skill and strength might win her love and hand. King Gunther, attracted by the fame of her beauty, goes to woo her, and Siegfried accompanies him as his friend and ally. Wearing a cloak of darkness which makes him invisible, Siegfried aids Gunther in defeating Brunhild in three tests of prowess—hurling for him the spear, putting the weight, and jumping with Gunther in his arms far beyond the limit that Brunhild could reach. So Gunther weds Brunhild, and she comes to dwell in the court at Worms. Later on she learns of the deception that has been practiced upon her, and that Siegfried and not Gunther was the warrior worthy of her hand. Not long after, Siegfried is treacherously slain by one of Gunther's followers; and Brunhild slays herself with his sword. Kriemhild vows vengeance on her brother, for she knows that he is really responsible for her lord Siegfried's death. She marries Etzel (Attila), king of the Huns, and after many years invites Gunther to visit the kingdom. He comes bringing his followers, but is met by a powerful army and overcome. Gunther is put to death and Siegfried is thus avenged.

The treasure again enters the story at this point, Kriemhild demanding from Hagen, a vassal of Gunther and the slayer of Siegfried, the hiding place of the hoard. He refuses to impart it, saying—

> None knoweth of the treasure save God and me alone:
> And unto thee, she-devil, it never shall be known.

Enraged, Kriemhild grasps Siegfried's sword and decapitates Hagen, but is herself slain by a follower of Etzel.

The story is thus filled with tragedy. This perhaps is due to that element in the story which was known to the older versions but forgotten in the later—the curse of the Nibelung hoard which falls upon all who possess it.

NICARA'GUA. The largest of the Central American republics and the most beautiful, Nicaragua stretches across the isthmus from the Caribbean to the Pacific coast. In colonial times its cities were known as "the first jewels of the Spanish crown," and its fertile lake plains described as an earthly Paradise. Yet, with wonderful mineral and forest resources and a marvelously fertile soil, it is still one of the least developed countries of Central America. Although it lies in one of the most celebrated and dangerous volcanic regions of the earth, man has done more to retard its progress than has nature. The eruptions of lava have created a marvelously fertile soil; but the century of seldom interrupted civil strife that followed the country's declaration of independence in 1821 has laid waste the cultivated plains time after time and made steady progress impossible. Until the intervention of the United States, in 1912, at the request of its president, Nicaragua was one of the most turbulent countries of Central America.

As in most countries of Central America, the majority of the people live along the volcanic Pacific slope. The principal port is Corinto, in the north, from which nearly two-thirds of the country's shipping is done. Leon, about 25 miles southeast, is the largest city, with a population of about 74,000. Its public edifices are considered among the finest in Central America. Still farther south is the capital, Managua (population, 61,000), situated near the foot of a mile-high pyramidal cone, Momotombo, on the south shore of Lake Managua, which is surrounded by volcanoes. Granada, a city of 21,000 people, stands on the beautiful Lake Nicaragua, which is also set about by giant volcanoes, their green-clad sides beautifully laid out with coffee plantations. Lake Nicaragua, 110 miles long and more than 3,000 square miles in area, is the largest lake in Central America. A railroad connects all of these towns with Corinto. The United States at one time planned a canal across Nicaragua but abandoned it in favor of the Panama route. In 1916, to prevent a competing canal under possible foreign control, the United States paid $3,000,000 for the exclusive right to build any such canal, and also acquired naval bases in the Bay of Fonseca on the Pacific coast and Corn Island on the Atlantic coast.

On the uplands near the Pacific the climate is mild, but elsewhere it is distinctly tropical, with a mean temperature of 80 degrees. There are but two seasons, the wet and the dry.

A Trip through the Country

On the slopes of the mountains and volcanoes and in the high plateaus are the great coffee plantations, where the principal crop of the country is raised. Much land is still uncultivated because of the scarcity of labor, but here and there in the fertile lake regions are fields of tall sugar cane waving in the breezes, cacao farms, and acres of tobacco, corn, rice, and beans, which are grown for local use.

The hot lowlands east of the Cordillera are practically uninhabited, but the Atlantic shore, in spite of unhealthful swamps and tropical forests, is of great commercial importance. Two hundred thousand acres are employed for the cultivation of bananas, and regular weekly steamboats operate between New Orleans and Bluefields, the principal Atlantic port, carrying shipments of coffee, bananas, mahogany, dye woods, rubber, hides, and some gold and silver.

The Indians of western Nicaragua have for the most part fused with the Spanish, making a fairly uniform population of mixed descent which adopted the language and religion of the invaders, although in most places it retained the Indian ways of living and tilling the soil. The population of the eastern half is composed mainly of Indians and negroes. There is less inequality between the classes than in some other Central American states. Laborers are free, and there is a rather wide distribution of land. The area is about 49,200 square miles. Population, about 750,000. (*See* Central America.)

Nice (*nēs*), France. Tucked in between the mountains and the sea, at the north of the gulf of Genoa, is the veritable little fairyland known as the Riviera. Behind it rise the Maritime Alps in sharp sea-crags and great rocks like ruined towers, protecting it from the harsh north winds. To the southward stretch the shimmering blue waters of the Mediterranean. And between, in a great crescent, lie the flower-decked foothills and the shining shores from which come so many fruits, perfumes, and flowers. Trees grow here which are not usually found so far north—date-palms and bananas, pepper trees, and the eucalyptus and the prickly pear. Olive groves alternate with acres of roses, violets, and hyacinths. And here thousands of tired or ill people have been made well again, and here the poet Shelley wrote, and died, and was burned in a magnificent funeral pyre at night on the Bay of Spezia.

At the extreme western end of the Riviera, in the small part that belongs to France—for most of it is in Italy—is the famous pleasure city of Nice. Here people go by the thousand every year to bask in the sun, to throw flowers and confetti at one another in the famous carnival, to watch the fireworks in the Villa des Fleurs, and to play in the Casino. Here visitors from the harsher northern climates find health, and perhaps happiness.

The town itself is divided into three parts—the New Town, the Old Town, and the Port. Nice has a cathedral, a museum, an observatory, and a library. Its main export is olive oil. Besides oil-works it has perfumery factories, soap works, tanneries, and furniture factories.

Nice was first settled over 2,000 years ago by Greek colonists of Marseilles, and received its name (Latin *Nicaea*, from Greek *Nike*, "victory") from a victory over the neighboring tribes. It became subject to Rome in the 2d century B.C. and since then has suffered in many wars and at the hands of many races. It was once in the hands of the Saracens; once the Turks pillaged it; it has belonged to Provence and Savoy, and was a part of the kingdom of Sardinia-Piedmont. In 1860 it was ceded to France as the price of aid rendered in creating the present kingdom of Italy. Its most famous son was Garibaldi, the knight-errant of Italian unity. Nice, like all the Riviera, has at times severe earthquakes. In the last century it suffered four times, the most severe being in 1887. Population, about 145,000.

Nicholas, Czars of Russia. An attempted liberal revolution (the "Decembrist" uprising) at the time he succeeded his brother Alexander I, helped to make Nicholas I (1825–1855) a thoroughgoing reactionary. An iron despotism and an elaborate spy system gripped Russia in his reign; and though he warred against Turkey in 1828–29 to enable the Greeks to win their independence, he used his armies to crush the Hungarian uprising against Austria in 1849. The chief event of his reign was the Crimean War (1854–56) which he began with a view to secur-

ing Constantinople and the lion's share of the inheritance of the "Sick Man of Europe." Chagrin at the failure of these plans, through the aid given Turkey by Great Britain, France, and Piedmont, was probably a factor in his death, at the age of 59 years.

NICHOLAS II, the last of the czars (1894–1917), was the great-grandson of Nicholas I and succeeded his father Alexander III on Oct. 24, 1894. He was a weak but well-meaning ruler, influenced largely by his wife (a German princess), who was under the influence of the reactionary element at the Russian court. A base but clever monk named Rasputin gained great influence by appealing to the superstitious fears of the czar and czarina. The first Hague Conference, called by the czar in 1899 to consider disarmament, showed a sincere desire to remedy the evils of militarism; but the disastrous Russo-Japanese War (1904–05) showed equally that the corrupt military element still controlled Russia. Widespread revolutionary movements which followed that war forced the czar to call the Duma (legislative assembly) which was expected to end autocracy and introduce constitutional government; but the "dark forces" were still too strong and by successive interferences with the Duma and the electoral law it was robbed of all power. When war threatened in 1914 Nicholas II was torn between his desire to protect Serbia against Austria and his fear of a general European war; he was hectored on one side by William II of Germany, and tricked by his own militarists.

When the war came, the criminal corruption, negligence, and lack of ability of the czar's officials brought severe defeat to Russia in the first two years. The inefficiency of the ministry, the failure to coöperate with the Duma, the suspicion that the court party meditated a separate peace with Germany, the forfeiture of public respect through the known influence of the monk Rasputin over the neurotic czarina and the feeble czar made a revolution inevitable. The storm broke in March 1917, and Nicholas was forced to abdicate the Russian throne. Immediately he became virtually a prisoner, and he and his family (the czarina and their four daughters and one son) were carried to Ekaterinburg in the Ural Mountains. There they lived until the Bolsheviki overturned the Russian government. On July 17, 1918, the czar and his entire family were brutally murdered by orders of the local soviet (*see* Russia).

NICKEL. Although the American coin called the "nickel" gets its name from the metal, it contains only one-fourth nickel, the rest being copper. In this alloy the red color of the copper is entirely masked by the nickel. Nickel is a metallic element, white with a faint yellow tinge, hard, ductile, malleable, highly magnetic, and capable of taking a high polish. This last property, coupled with the fact that it rusts very slowly, makes it useful as a coating for other metals. The nickel coat is applied by the process of electroplating (*see* Electroplating). Alloyed with two parts of copper and one of zinc, nickel forms a

WHERE NICKEL STARTS ON ITS TRAVELS

For all you know, the 5-cent piece you have in your pocket began life in this island of New Caledonia in the far-away Pacific, for this island contains important deposits of nickel ore. You see how the machine scoops out the ore from the bank and loads it into waiting cars.

bright silvery metal known as "German silver" or "nickel silver," largely used for making cutlery, table ware, and as a basis for silver-plated ware.

Although most of us know nickel chiefly in the forms just mentioned, these uses are comparatively unimportant and take only about 20 per cent of the total annual supply. Nearly 80 per cent of the nickel used in the United States goes into the manufacture of nickel steel, an alloy which is especially adapted to withstand repeated strains. It is therefore used in armor plate, cannon, structural work, bridges, railroad rails at curves, steel castings, engine forgings, and shaftings and axles especially in automobiles and railroad cars. Combined with copper and rolled into sheets, nickel is used for bands on shells and bullet jackets. Alloyed with copper, iron, and cobalt, it forms a valuable rust-resisting material which is largely employed by the United States navy for propellers and propeller shafts, and has many important industrial uses, as for valves, pump rods, and roofing materials. A combination of nickel steel with manganese, silicon, and chromium gives the hard alloy *invar*, which is much used for measuring implements and pendulum rods because it is practically non-expansive within normal temperature variations. A nickel steel containing carbon called platinite has almost the same rate of expansion under heat as glass, and so may be used as a substitute for platinum for the wires in incandescent electric bulbs.

Nickel is dissolved with difficulty by most acids except nitric acid, which readily attacks it, and forms a green solution. The green liquid often seen in peculiarly shaped glass vessels in the windows of drug stores is likely to be a nickel salt dissolved in water.

The world's chief source of nickel is in the mines of Sudbury, Ontario, where the principal ore is called "pentlandite." Small amounts come from the islands of New Caledonia and Tasmania. Nickel also occurs free in meteorites, but this source is of no commercial value.

NICKNAMES. "Nicknames and whippings," said Walter Savage Landor, "when they are once laid on, no one has discovered how to take off." Nations, like persons, have nicknames which grow up in curious ways and become fixed. The nickname 'Uncle Sam," applied to the United States, is known the world over. This is the way it originated. During the War of 1812 someone inquired as to the meaning of the letters "U. S." stamped on government goods. He was told that they stood for "Uncle Sam," the local title for Samuel Wilson, the government inspector. This jest was repeated throughout the country; the name stuck, and "Uncle Sam" came to personify the United States government and the American people.

This nickname became even more popular than the earlier one, "Brother Jonathan." The original of the name "Brother Jonathan," according to the story, was Washington's friend, Gov. Jonathan Trumbull of Connecticut. When perplexed by the need of arms and war material, General Washington would say, "We must consult Brother Jonathan." This expression, being often repeated, came into common use and at last was extended to the American nation as a whole.

Brother Jonathan, like Uncle Sam, is always portrayed as a tall thin man with long narrow beard, long-tailed coat, high hat, and a shrewd but humorous, countenance—attributes which marked the typical American of the early days.

Very different is "John Bull," the personification of the English nation, who is represented as a stout, ruddy-faced, matter-of-fact, blunt fellow attired in leather breeches and top-boots, generally with a cudgel in his hand and a bulldog at his heels. The name "John Bull" was first used in a political satire published by Dr. Arbuthnot at the time of the War of the Spanish Succession, in Queen Anne's reign.

There are many nicknames, generally of an uncomplimentary character, applied by the people of one nation to those of another. Thus the American called the Mexican a "Greaser," referring to his untidy appearance; while to the Mexican or Spanish-Amirican an American or Englishman is a "Gringo" (from the Spanish word for gibberish or unintelligible speech). (*See also* Yankee.)

Some people have thought that the word nickname came from "nick," to cut, since a nickname is often a shortened form of the full name; but the word was originally "eke name" and meant an added name.

NIGER (*nī'ĝĕr*) **RIVER.** To see the soul of tropical Africa, there is nothing better, perhaps, than a voyage down the great Niger River, next to the Congo and the Nile the largest stream in the Dark Continent. Its course of 2,600 miles leads through mountainous uplands, traverses broad flat prairies, skirts the vast sandy wastes of the Sahara Desert, plunges through giant forests, and feels its way to the ocean through a score of mouths, bordered with mangrove swamps.

Rising only 150 miles from the sea in French Guinea, above Sierra Leone, it sweeps first northeastward, then southeastward, then straight south into the Gulf of Guinea, forming a great arc which incloses one of the richest and most picturesque of African empires—a region chiefly divided between France and Great Britain.

As a navigable stream, the Niger is of immense importance. Steamers of light draft can make their way over most of its length, and through its largest tributary; the Benue, it provides a highway for 900 miles eastward into Central Africa. A railway connects the upper reaches of the Niger with the Senegal River emptying on the extreme west coast. Thus by boat and rail travelers can reach the famous markets of Sansandig, Segu, Timbuktu, and other river stations far in the interior toward the desert. The Niger shipping is chiefly engaged in transporting the palm oil, nuts, copal (a resin used for varnishes), tree gums, rubber, coffee, ivory, and other products of this vast and luxuriant river basin.

The Niger delta is one of the most remarkable in the world, consisting from 40 to 70 miles from the seacoast of a great network of interlacing creeks and broader channels in which mingle the waters of small independent streams until it is impossible to trace the main river. The chief entrances for large ships are the Nun Mouth, the Forcados, the Brass Mouth, and the Bonny. The climate of the delta is one of the most unhealthful in Africa, but the British who control this portion of the Niger valley are slowly stamping out disease spread by mosquitoes and the dreaded tsetse fly.

Though the Niger River was known by reputation to the ancients, its course was not accurately mapped until late in the 19th century because of the obstacles placed in the way of explorers by the fierce tribes of black cannibals dwelling along its banks. (*See also* Africa.)

NIGHTHAWK. The "high-dive" is this bird's specialty. With wings almost folded, he will plunge downward from a height of several hundred feet until within a few feet of a housetop or of the ground; then with a sudden spreading of his wings he checks his dizzy descent and swoops upward, to repeat the thrilling exhibition over and over. No satisfactory explanation for this trick has been found. Some observers believe the nighthawk is pouncing upon an insect, but if this is the case his power of sight must be almost beyond comprehension, and why would he repeat the dive again and again?

A LIVING INSECT TRAP

While the Nighthawk spends its days quietly crouching in some tree or cranny, by night it swoops through the air with its huge mouth wide open, trapping scores of hapless insects.

This bird has a great froglike mouth that opens from ear to ear. During flight, it is held wide agape and like a trap catches in vast numbers the winged insects on which the bird feeds. The stomach of one bird was found to contain the remains of 1,800 flying ants, and another the remains of 34 June-bugs. Curiously enough, the beak that goes with this great mouth consists merely of a tiny tip, less than a half-inch in length.

The nighthawk belongs to the same family as the whippoorwill. To speak of it as a "hawk" is most misleading, for the bird has neither the disposition nor the appearance of a hawk. The nickname "goatsucker" and "bull-bat" are no more apt, but the term "night-jar," often applied to it, might describe the effect either of the booming sounds made by the rush of air through the taut feathers of the wings during its spectacular dive, or of the sharp "pec-cnt!" it utters as it circles through the dusk of evening.

The large wings of the nighthawks are quite out of proportion to their robin-sized bodies. The plumage is a mixture of black, gray, brown, and buff, almost invisible against the bark of a tree. When in flight a patch of white is conspicuous on each wing, distinguishing them from their relatives, the whippoorwills. Their legs are small and weak, so they sleep sitting lengthwise on limbs instead of sidewise as most birds do. (For illustration in color, *see* Birds.)

Nighthawks nest in gravelly places—in open fields or on large flat rocks; sometimes on gravel roofs in cities. They lay two grayish-white eggs, spotted with black. They breed throughout eastern North America from southern Yukon to the northern Gulf States. They winter in South America.

The nighthawk (*Chordeiles virginianus*) belongs, like the whippoorwill, to the goatsucker family (*Caprimulgidae*), which is related to the swift and humming-bird families.

NIGHTINGALE. No bird has been more celebrated in literature than the nightingale, which is the poet's own bird. Homer wrote of the "sweet, tawny nightingale"; Milton called it the "most sweet, most melancholy bird," and Keats is writing of the nightingale when he writes of the

> . . . . song that found a path
> Through the sad heart of Ruth, when, sick for home,
> She stood in tears amid the alien corn;
> The same that ofttimes hath
> Charm'd magic casements, opening on the foam
> Of perilous seas, in faery lands forlorn.

Americans have to go abroad to hear this most famous of birds, for it does not occur on the west of the Atlantic. The hermit thrush and mocking bird are the only American birds that approach the nightingale in beauty of song. It is found throughout Europe, most abundantly in southern France, Spain, and Portugal, and in parts of England. Its song is heard most often in the spring, for a few weeks after its return from the South. The Persian *bulbul*, and another species of night-singing bird found in Asia, are probably the nightingales of the Persian poets and the Greeks and Romans.

THE NIGHTINGALE

The male (above) and the female (below) are almost identical in size and coloring. It is the male whose song is so celebrated.

During the mating and nesting season, from the middle of April to the middle of June, the male, perching near his tiny house, sings both day and night. His song is a melodious outpouring of glorious tone and is evidently an expression of devotion to his mate, for although the bird endures cage life, the male sickens and dies if taken during this time of the year.

The sober appearance of the nightingale is in striking contrast to the richness of his song. The bird is about six inches long, with rusty brown and gray plumage, and is shy and quiet in its habits, frequenting shrubs and low trees.

The nightingale belongs to the family of Warblers, or *Silviidae*. The common European nightingale is the *Daulias luscinia*. A larger eastern species is *Daulias philomela*. The famous *bulbul* of the Persian poets is *Daulias hafizi*.

NIGHTINGALE, FLORENCE (1820–1910). This Englishwoman, the first and greatest of woman war-nurses, who revolutionized the methods of caring for sick and wounded soldiers, was born in the city of Florence, Italy; but she grew up on her father's country estate in Derbyshire, England. There, while still a child, she helped a doctor set and bandage a collie dog's broken leg, and nursed the grateful animal back to health. At 18 she was taken to London and presented to the young queen Victoria.

As a debutante in court circles she could have had a gay season and perhaps made a brilliant marriage. But caring nothing for society, she spent her time in studying the work of the great hospitals. In a year or so she left her beautiful home and friends to take the hard training of a nurse in convent hospitals on the Rhine and in Paris. At that time it was an unheard-of thing for a gentlewoman to become a professional nurse.

Returning to England Miss Nightingale attracted attention at once by reorganizing the sanitarium of the London Institution. She was 34 years old, and widely known in the medical world, when the Crimean War broke out, and a British army was sent overseas to help Turkey against Russia. When reports came of the terrible sufferings and high death rate of the sick and wounded English soldiers and sailors, she offered her services to the government. Within a week she enlisted 37 nurses, filled a ship with supplies, and steamed to Scutari, where she arrived in time to receive the wounded from the famous battle of Balaklava.

The story of Miss Nightingale's heroic labors in hot and fetid camps, and in barracks which served for hospitals, is one of the brightest chapters in British military annals. England's bravest and best were dying like flies when she took charge. She soon reduced crowding, confusion, dirt, and neglect to space, order, cleanliness, and prompt attention. The death rate fell from 40 to 2 per cent. When stricken with fever herself, she refused to leave her post. No matter how long and hard had been a day's work, she always made the night rounds of the wards, lamp in hand, to see that the attendants were on duty, and to speak cheering words to her charges. Ever afterwards she was known with grateful affection as "The Lady with the Lamp." One of the many tributes paid to her at the time was Longfellow's poem 'Santa Filomela'.

When the war was over, a British naval vessel was dispatched to fetch Miss Nightingale home. But taking a French steamer she slipped into England unnoticed. The fund of 50,000 pounds sterling ($250,000) that was raised for her by popular subscription she used to found the Nightingale Home for Convalescents.

Her health had been so undermined by her war work that, although she lived to the age of 90, she was always an invalid. Nevertheless her life continued to be one of the widest usefulness. She wrote standard books on nursing and advised many countries on the building and managing of public, private, and military hospitals. No one else did so much as she to raise the profession of nursing to the high place which it holds today.

NIGHTSHADE. Bobbing up here and there in the waste places of various parts of the world is a weed, related to the potato, whose slender erect 12-inch stem, pointed oval leaves, drooping clusters of white flowers, and small rather round berries are often regarded with suspicion. However, it is only when animals chew the fresh leaves of this common or black nightshade, or when people eat too many of its berries, that injury results. The leaves are boiled in some warm climates and eaten as a sort of greens.

Another plant of this nightshade group is the blue-blossomed bittersweet whose somewhat poisonous scarlet berries taste both bitter and sweet. Still another kind that is not very harmful is the horse nettle or apple of Sodom with its orange berry, which is a native of western North America. Many of the different nightshade plants contain an element that will slightly deaden pain. It is, however, a plant of an allied genus found in various parts of Europe and Asia, whose leaves and roots are particularly used in medicine. This is the deadly nightshade or belladonna, a disagreeable-smelling five-foot shrub with dull green leaves, purple bell-shaped flowers, and black cherrylike fruit. Because it can dilate the pupil of the eye, atropine, obtained from this plant, is especially used by oculists.

There are many species of the typical genus *Solanum*, of the nightshade family (*Solanaceae*). Scientific name of common nightshade, *Solanum nigrum;* of bittersweet, *Solanum dulcamara;* of deadly nightshade, *Atropa belladonna*.

NILE RIVER. For thousands of years there has been a question as to where the Nile, the longest river of Africa and after the Missouri-Mississippi the longest river in the world, may be said to begin. In one sense it begins at Khartum. Here the Blue Nile, flowing clear and blue from the Abyssinian mountains or reddish-brown in flood time, meets the grayish-green White Nile which comes from the lake

region of Central Africa. The sources of the Blue Nile were known in ancient times, but of the White Nile the geographers told legends of the Mountains of the Moon and of underground channels. It is only in recent times that explorers have followed it back through the swampy "sudd" region with its reeds, white, blue, and crimson water-lilies and other floating vegetation, and its mosquitoes, past the rapids and waterfalls in which it descends from Albert Nyanza (*nyanza* means "lake") like a gigantic mill race to the lake itself, and thence through the beautiful gorges of the Victoria or Somerset Nile which feeds Albert Nyanza to Victoria Nyanza, and thence to the streams which feed this lake.

From Khartum to Assuan the Nile descends in six cataracts. After Khartum it receives only one tributary, the Atbara, another Abyssinian stream, which is 600 yards wide in flood time, and between whiles almost dries up, so that fish, turtles, crocodiles, and hippopotami remain imprisoned in the deep pools of its upper reaches until the next flood time. After watering the whole land of Egypt the Nile finally reaches the Mediterranean through two channels. These are called the Rosetta and the Damietta mouths and the general region is known as the Delta. Having received no new tributaries and having lost much through seepage and evaporation, the Nile ends as a smaller stream than it was higher up. In summer it does not really reach the sea at all.

The yearly flood of the Nile has for centuries been the secret of Egypt's fertility. The heavy April rains in the basin of the White Nile start the first flood and the May rains in Abyssinia give the real flood of rich muddy water that fertilizes as well as irrigates. The great dam at Assuan stores up the surplus flood and releases it later on, so that the Nile valley may be watered all the year around. The length of the Nile from Victoria Nyanza to the Mediterranean is about 4,000 miles. The Blue Nile is about 840 miles long. (*See* Egypt.)

NINEVEH (*nĭn'ĕ-vĕ*). When the people of Israel were groaning under the heavy yoke of the proud and ruthless Assyrian kings, the Old Testament prophets called down the vengeance of heaven on Nineveh, the splendid capital of the Assyrian Empire. "Woe to the bloody city!" they cried. "The Lord will make Nineveh a desolation and dry like a wilderness." The prophecy was fulfilled when the hordes of the conquering Medes and Chaldeans more than 25 centuries ago (606 B.C.) swept over the doomed city and made it a desolate waste. As the centuries went on the sun-dried bricks of which most of the houses were built crumbled to dust, and the drifting sands covered the ruins, mounting higher and higher, until every trace of the once mighty capital was lost and the very memory of its location had disappeared except for a native tradition.

It was not until the middle of the 19th century that scholars set to work on the vast flat-topped mounds with pick and shovel, and uncovered evidence that they did indeed mark the site of one of the most magnificent capitals of antiquity. More than that, the walls and sculptures and libraries they brought to light have enabled men of science to rewrite the great lost chapters of history that tell of the empire of the Assyrians. Nearly every important fact we have today about Assyria has been discovered since our grandfathers went to school, as the result of the excavations at Nineveh and other sites in the ancient valley of the Tigris.

One of the earliest and most successful of these investigators was an Englishman, Sir Austen Layard, who unearthed the great palaces of Sennacherib and Ashurbanipal (1845–51), with their alabaster bas-reliefs of hunts and sieges and battles, and colossal winged man-headed statues of bulls and lions. Most important of all, he found many thousand tablets of Ashurbanipal's library, which have now been deciphered and tell us the story of science, history, religion, and literature in the days of Assyria, and Babylonia as well. Excavations have been proceeding ever since, but incalculable treasures still remain to be brought to light.

The mounds, extending at intervals for some 15 miles along the Tigris, opposite the modern city of Mosul, represent not only the city of Nineveh proper, but also of Dur-Sargon, the city of Sargon II, and Kalah. Nineveh, though it existed at least as early as 2000 B.C., was chiefly the creation of Sennacherib (705–681 B.C.), who walled and fortified it for two and a half miles along the Tigris, building a great new palace, and laying out extensive gardens. (*See also* Babylonia and Assyria.)

NIOBE (*nī'ō-bē*). One of the saddest stories in Greek mythology is that which tells how the proud Niobe, daughter of Tantalus and wife of Amphion, king of Thebes, was punished for her presumption. She boasted of her seven sons and seven daughters and despised the goddess Leto (Latona) who had only one son and one daughter. But the children of Leto were the great Apollo, god of the sun, and Artemis (Diana), goddess of the moon, and for this arrogance they slew all the children of Niobe with their arrows. Niobe's grief was so great that Zeus out of pity changed her into a rock on Mount Sipylus, from which tears continued to flow.

NITRIC ACID. The strongest explosives known are made by the action of nitric acid upon various organic compounds. The pure acid is colorless, and is about half again as heavy as water. It colors the skin yellow and causes severe burns. Nitric acid attacks and disintegrates most substances with which it comes in contact. It even dissolves most of the ordinary metals, except gold, platinum, and aluminum.

Nitric acid is chiefly made by distilling a mixture of Chile saltpeter (sodium nitrate) and sulphuric acid and condensing the vapor. In the electric arc nitrogen and oxygen of the air combine to form the gas nitric oxide, which when cooled and brought into contact with water makes nitric acid. This is one

of the best known ways of converting the free nitrogen of the air into a fixed form for use in agriculture and the industrial arts.

When the metals or their compounds with oxygen, or carbonates, are dissolved in nitric acid, salts called nitrates are formed. Some of these nitrates are useful in medicine; others are in common use as fertilizers; and still others make the red and green lights in fireworks. Nitric acid and sulphuric acid act on cotton and glycerin to form nitrocellulose and nitroglycerin, which are strong explosives. Trinitrotoluol—the TNT with which shells were filled and which had many other uses in the World War—is also a derivative of nitric acid. (*See* Chemistry.)

NITROGEN, PRESERVER *and* DESTROYER *of* LIFE

The Strange True Adventures of the Changeable Unfriendly Element that Makes up Four-Fifths of the World's Atmosphere—Sluggard and Worker, Giant and Dwarf, All in One

NITROGEN. Lazy giant and fire-eating dwarf—that is nitrogen, most contradictory of elements, which changes its nature, as if by enchantment, when it enters into combination.

Four-fifths of the great sea of air that rolls about the earth is free nitrogen—nitrogen which is not combined chemically with any other element, but merely mixed with free oxygen. That is nitrogen the sluggish giant.

It loves its freedom; it hates to enter into combination; the chemists call it inert. You breathe it into your lungs along with the oxygen that reddens your blood—four times as much of it as of the oxygen. But the oxygen unites with the living blood; the lazy nitrogen is breathed out again unchanged. When the oxygen in a closed jar or sealed room is used up, fire cannot burn in the remaining nitrogen, and plants and animals smother to death.

Nitrogen, however, is particular about the company it keeps; it enters into direct combination with only a few of the commoner elements. Here and there other elements have caught a little nitrogen and coaxed it into uniting with them. Because nitrogen does not like society very well at best, there is little combined or fixed nitrogen on the earth in comparison with the great floods of free nitrogen which bathe our planet. This small quantity of fixed nitrogen we may call nitrogen the dwarf.

Nitrogen in High Explosives

Curiously enough, the combinations which contain fixed nitrogen are generally very active. They break up easily, because nitrogen, you know, hates to be tied down. These are the compounds which chemists call labile or unstable. Some of them break up with great violence. You might imagine that nitrogen, like some persons who are good-natured enough so long as they are let alone, becomes very irritable when forced into company it does not like, and does not care what it does to get away. Some of these easily and violently breakable compounds of nitrogen enter into our high explosives like gunpowder, guncotton, dynamite, nitroglycerin, and trinitrotoluol (TNT).

Nitrogen the busy dwarf, however, is not always ill-tempered and malicious. Indeed, the most marvelous of the properties of this wonderful element remains to be told. In its free state it is indifferent to life; in many of its combinations it is an enemy to life. Yet without it life could not exist. Every living thing, plant, or animal, must have nitrogen in its tissues. Where can they get it?

There is untold wealth of nitrogen in the air, and we are forever breathing it into our lungs, but that does not help a bit to supply our need of nitrogen, for the stubborn element refuses to enter into combination with animal tissues in that way. Animals must supply all their nitrogen needs through foods of plant or animal origin. That is, all animals obtain their nitrogen finally from plants.

Now, most plants are just as helpless to coax free nitrogen out of the air as are all animals. Except for certain peculiarly gifted plant organisms, to be mentioned later, all plants must draw their supply of fixed nitrogen from the soil.

The Little Nitrate Factories under the Ground

And where does the soil get its nitrogen? From the air—from the reluctant free nitrogen of the air: and the ways in which it gets fixed nitrogen from the air form an interesting study.

The soil obtains some of its nitrogen compounds by the aid of the lightning and the rain. Lightning burns the air in its path; that is, it heats the nitrogen and oxygen until they unite to form oxides of nitrogen. These oxides are washed into the soil by the rain. This is a slow, age-long process.

Then, too, there are certain tiny organisms which form an exception to the rule that plants draw their nitrogen from the soil. These are called "nitrifying" bacteria; they alone among living creatures have the power to obtain free nitrogen from the air and to combine it with other elements. These nitrifying bacteria live in little nodule-like colonies on the stems of certain leguminous plants, such as alfalfa, clover, beans, and peas. In return for their lodging, the nitrifying bacteria turn over to their hosts, the clovers or the alfalfas or the beans or peas, the nitrogen which they have fixed within their bodies, and the leguminous plants, when they decay, turn their nitrogen compounds into the soil. Thus soil on which these crops have grown becomes enriched by their decay. (*See* Alfalfa.)

Farmers and planters know that growing certain crops, such as wheat, tobacco, and cotton, too long on the same fields "wears out the land," so that it will no longer produce these crops. This is because they take from the soil more of the elements necessary for plant life than they give back to it, so that in time there are not enough of these compounds left for good crops. To keep the soil in good condition while growing nitrogen-consuming crops, the farmer must either use nitrogen-containing fertilizers, such as guano and inorganic nitrates, or he must "rotate his crops," so that a nitrogen-using crop is followed by a nitrogen restoring crop.

The fixed nitrogen of the earth is like a fortune which has been slowly heaped up by the painful toil of one generation of owners after another, but which one spendthrift heir can scatter in a few short years. The human race has played the part of the spendthrift heir. Human beings have long wasted the precious fixed nitrogen like prodigals. Untold amounts of nitrogen-containing animal wastes have been and are being allowed to escape to the sea in sewage. A single explosion of a modern piece of artillery, it has been said, frees the nitrogen which it has taken millions of bacteria ages to accumulate. Therefore it is most important that these wastes should be checked before the world begins to starve for lack of nitrogen compounds. Two very cheering facts are these:

(1) A way has been discovered of speeding up the plant processes of adding nitrogen to the soil. This is by inoculating the soil on which leguminous plants are to be grown with cultures of nitrifying bacteria.

(2) Inventors have found ways of making nitrogen compounds artificially direct from the free nitrogen of the atmosphere. This again is by the use of one of Nature's processes, speeded up to meet man's needs. Instead of waiting for lightning to make nitrogen compounds, here a little, there a little, through millions of years, the electric spark is kept busy urging nitrogen into union with some other element. One process produces nitric acid; others, either by the help of catalysts or through the formation and breaking up of intermediate compounds, produce ammonia; still another induces nitrogen to combine with calcium carbide, producing a compound of nitrogen, calcium, and carbon called calcium cyanamide and used as a fertilizer. The first process for making artificially fixed nitrogen was worked out in the United States and tried at Niagara Falls, but, failing to prove profitable there, received its greatest development from the immense water-power facilities of Norway. During the World War interest in the artificial fixation of nitrogen was renewed in the United States, and an immense plant was built at Muscle Shoals, Ala.

This is not all of the story that scientists have pieced together about nitrogen since its discovery in 1772 by Daniel Rutherford, of Edinburgh. You must remember that its chemical symbol is N, that it is just a little lighter than pure air, but is over 14 times heavier than hydrogen. That it is colorless, odorless, and tasteless you may know for yourself if you will remember that you cannot see or smell or taste it in the air. Nitrogen enters not only into foods, but also into poisons, medicines, perfumes, and dyes. One of its commonest compounds is the common household ammonia (*see* Ammonia). Then, too, there are the anesthetic nitrous oxide or "laughing gas," and the useful solvent nitric acid (*see* Nitric Acid). In fact, there is no room here to tell of all the shapes worn by nitrogen the changeable dwarf, or all the wonderful things it does.

PREPARING NITRATES FOR MARKET

Sodium Nitrate or "Chile saltpeter" is one of the commonest compounds of nitrogen used in the preparation of fertilizer. The raw material is found in great deposits along the western coast of South America, and is treated by boiling, concentration, and crystallization. These are the evaporating tanks where the commercial crystals are formed.

NOBEL PRIZES. Alfred Bernhard Nobel (1833–1896), the Swedish inventor and philanthropist, provided in his will for a series of five prizes—each of about $50,000—to be given each year to the persons who have made the greatest contribution towards the progress of the world in the realms of physics, chemistry, medicine, literature, and peace. The awards were first made in 1901, the decisions being made by the Royal Academy of Science, by the Caroline Medical-Chirurgical Institute, and by the Swedish Academy (all three of Stockholm); and—for the peace prize—by the Norwegian Storthing (Parliament). Among the prize winners are several Americans including Woodrow Wilson, Theodore Roosevelt, and Elihu Root, for their labors in behalf of peace; Dr. Alexis Carrel in medicine; Prof. Theodore Richards of Harvard University in chemistry; and Prof. Albert A. Michelson of the University of Chicago,

Thomas A. Edison and Nikola Tesla in physics. A few women have been honored: Madame Curie (French) received the prize one year in physics; Selma Lagerlöf (Swedish), in literature; and Baroness Bertha von Suttner (Austrian), in the promotion of world peace. Among those receiving the prize for distinguished literary work of an idealistic tendency are Björsterne Björnson, Rudyard Kipling, Maurice Maeterlinck, Gerhardt Hauptmann, Rabindranath Tagore, and Knut Hamsun.

NORFOLK, VA. In the center of the fertile tidewater section of Virginia, and midway on the Atlantic seaboard, are the twin cities of Virginia—Norfolk and Portsmouth, separated only by a little stream called the Elizabeth River. Situated at the broad mouth of the James River, and "next door" to Chesapeake Bay, their commodious harbor, numerous steamship lines, transatlantic and coastwise, and large traffic with the interior by railroad and canal give them increasing commercial importance. Together they constitute the largest naval station in the United States—the Norfolk Navy Yard, located at Portsmouth. Portsmouth, on the western side of the harbor, is the home of many business men of the greater city; but Norfolk contains three times the population of its neighbor, and is the greater industrial and commercial center.

The market gardens and farms of the adjoining region are the great underlying foundation for Norfolk's prosperity. Its annual shipments of green stuffs and fruits to the north are valued at many millions of dollars. In addition, it is the largest peanut market in the world, the fourth cotton port of the United States, and one of the largest coal shipping stations in the country; besides having a valuable trade in fish, oysters, and lumber. Norfolk is also developing rapidly as an industrial center. Among its important industries are fertilizer works, and lumber, hosiery, knitting, cotton, silk, and oil mills, tobacco and cigar factories, iron foundries, and shipyards. The Gulf Stream, which runs nearer the coast here than at any other point in the country, gives the region a genial climate, and famous seashore resorts add to the attractiveness of the surrounding country. Population, about 116,000.

NORMANDY, FRANCE. A country of shimmering streams, of widespread orchards of cider apples, brilliant in the spring with white and pink blossoms; a country of wide straight roads smooth as floors, lined with an endless procession of towering trees, behind which hide trim little farm houses with neat thatched roofs—such is the ancient French province of Normandy, whose curving shores form the middle section of France's northern coast. Fronting these shores beyond the Channel lies England, long linked with Normandy in history.

It was into this region that the Northmen poured in the 9th century, steering their dragon-prowed ships up the wide mouth of the Seine, and carrying fire and sword along the winding banks of this great river far inland toward Paris. It was here in 911 that King Charles the Simple of France did a very wise thing by signing a treaty with their chief Rollo, which gave the Northmen a permanent home on French soil.

In the century and a half that followed, the Northmen leaders became Norman dukes—Christian, French speaking, and among the most progressive of French lords. From one Norman family five tall sons found their way to southern Italy and began the founding of a Norman kingdom of Naples and Sicily there (after 1037). The dukes of Normandy meanwhile rose in power until one of them, William, crossed the Channel and took possession of England in 1066, winning immortal fame as "The Conqueror."

Transfer of Power to England

William carried over the germs of many institutions that were later to develop into England's most precious contributions to law and government. But the seat of power was soon transferred across the water, so that it was England that owned Normandy, instead of Normandy that owned England. Normandy leaders then rebelled and called in the French kings. Disorder and confusion followed until the French king Philip Augustus conquered Normandy from King John of England. The struggle was renewed in the Hundred Years' War (1338–1453) which ended in the expulsion of the English not only from Normandy but from all France. After this, Norman history was less eventful.

But the centuries of its stirring early history have left their marks on this fair land. In the ancient city of Caen on the Orne River, about ten miles from the Seine Bay, stand two famous abbeys, the Abbey for Men and the Abbey for Women, built by William the Conqueror and his wife Matilda to pacify the pope who disapproved of their marriage. Near Caen is placid little Bayeux, another of the Conqueror's towns, where is kept the famous Bayeux "tapestry," a seamless strip of linen, 230 feet long and 20 inches wide, covered with 58 colored sketches in worsted embroidery depicting the incidents in William's conquest of England.

But most famous of all Normandy towns is Rouen, the ancient stronghold of the Northmen, and the place where Joan of Arc was burned at the stake. Here is a fine Gothic cathedral, in which Henry II of England lies buried, and where once was entombed the lion heart of his son Richard I. Picturesque crooked old streets remain side by side with modern boulevards and fine quays bordering the Seine.

The Harbors of Normandy

Normandy has some of the finest harbors in France, among them Le Havre at the mouth of the Seine; Cherbourg, at the tip of the great peninsula of Cotentin; and Dieppe, in the northeast.

The people of this old province are mostly tall, blue-eyed, and fair-haired, showing their descent from the Northmen. They are among the most hardy and industrious inhabitants of France, proud of their ancestry and of the beautiful fertile country.

The NORTHERN HALF *of the* NEW WORLD

Extent.—North and south, about 4,500 miles; east and west, 3,000 miles. Area, 10,050,000 square miles. Population, about 143,000,000 (Europeans, 121,000,000; negroes, 14,000,000; Indians and Eskimos, 8,000,000).

Mountains.—On the east the Appalachian System—White and Green Mountains, Adirondacks, Blue Ridge (highest peak, Mt. Mitchell, 6,711 feet). On the west the Cordilleran System—Rocky Mountains (highest peak, Mt. Logan, 19,539 feet); Alaskan Mountains (highest peak, Mt. McKinley, 20,464 feet, the highest on the continent); Cascade Range (highest peak, Mt. Rainier, 14,408 feet); Sierra Nevada (highest peak, Mt. Whitney, 14,502 feet); Sierre Madre (highest peak, Mt. Orizaba, 18,250 feet); Coast Range.

Rivers and Lakes.—Rivers: Missouri-Mississippi (4,220 miles), Mackenzie (2,400), Yukon (2,050), St. Lawrence (2,000), Nelson (1,800), Rio Grande (1,800), Columbia (1,400), Colorado (1,100). Lakes: Great Lakes (Superior, Michigan, Huron, Erie, Ontario), Great Bear, Winnipeg, Great Slave, Nicaragua, Great Salt.

Political Divisions.—United States (including Alaska, Panama Canal Zone, and Porto Rico) 3,621,550 square miles; Canada, 3,730,000 square miles; Mexico, 767,198 square miles; Central American States (Guatemala, Honduras, Nicaragua, Salvador, Costa Rica, and Panama); Cuba; Haiti; Dominican Republic. British possessions (excluding Canada), Newfoundland and Labrador, Bahamas, Bermudas, British Honduras, Jamaica. Danish colony, Greenland.

NORTH AMERICA. When we look back upon the history of North America we cannot but wonder what qualities this continent possessed that caused it so far to surpass the other "new" worlds in the race for people and wealth and power. In the short space of four centuries it has emerged from barbarism, outstripped the centuries-old civilization of Asia and northern Africa, and taken its triumphant place alongside of Europe as a leader in the world's progress. South America, Africa, and Australia shared with North America in Europe's explorations and civilizing influence; but none of these has experienced so miraculous a transformation as that which overtook North America.

A glance at the map will reveal one very important reason for this preëminence. Africa, with the most regular coast line of all the continents, not only offers few safe harbors for ships, but has a rampart of coastal mountains all about the interior, so that its rivers are barred by cataracts which make passage up them difficult. South America also offers few bays and inlets where an explorer might safely land, and the long navigable rivers often lead only to tropical forests where white men could not live. Australia, the most isolated of the continents, turns its back to European influence, having its most accessible part in the southeast, facing the empty Pacific Ocean.

Why North America Prospered

Of all the continents North America was the most hospitable to European influence. It alone opened wide its rivers and harbors to immigration, making it easy for newcomers to reach a hospitable interior. Except Europe, it has the longest shore line in proportion to its size of any of the continents, causing many excellent harbors. It is also in the middle latitudes—the region that is preëminently "white man's country." There are no high mountains barring entrance to the fertile interior, and the vast central plain stretches unbroken from the Arctic Ocean to the Gulf of Mexico, with an unequaled system of waterways.

It was fortunate for America that its discoverers did not come first to the Pacific coast, for there they would have found a more uniform coast and high mountains facing the Pacific in an almost unbroken wall. Except in the north, there are few good harbors; and on the whole coast there are only two rivers valuable for navigation—the Yukon, which opens into the heart of Alaska, and the Columbia, which leads to great mountain systems and an inhospitable country. The only other westward flowing river of importance—the Colorado—drains a large but arid region, its chief gift to mankind still being the scenery of its majestic canyon. Alaska on the west balances Labrador on the east, as Lower California balances Florida; but such great gulfs as Hudson Bay and the Gulf of Mexico are lacking on the Pacific side. If, however, Asiatic nations had been the expansionists of the 15th century, they could have reached our continent without a long sea voyage, either by the stepping stones of the Aleutian Islands, or by Bering Strait, which at one point is only 40 miles wide. Both routes were probably used by native tribes in peopling the Alaskan and British Columbian regions; and elephant-headed hieroglyphics in Aztec Mexico point to an ancient canoe connection with more southerly Asia at some period in America's history.

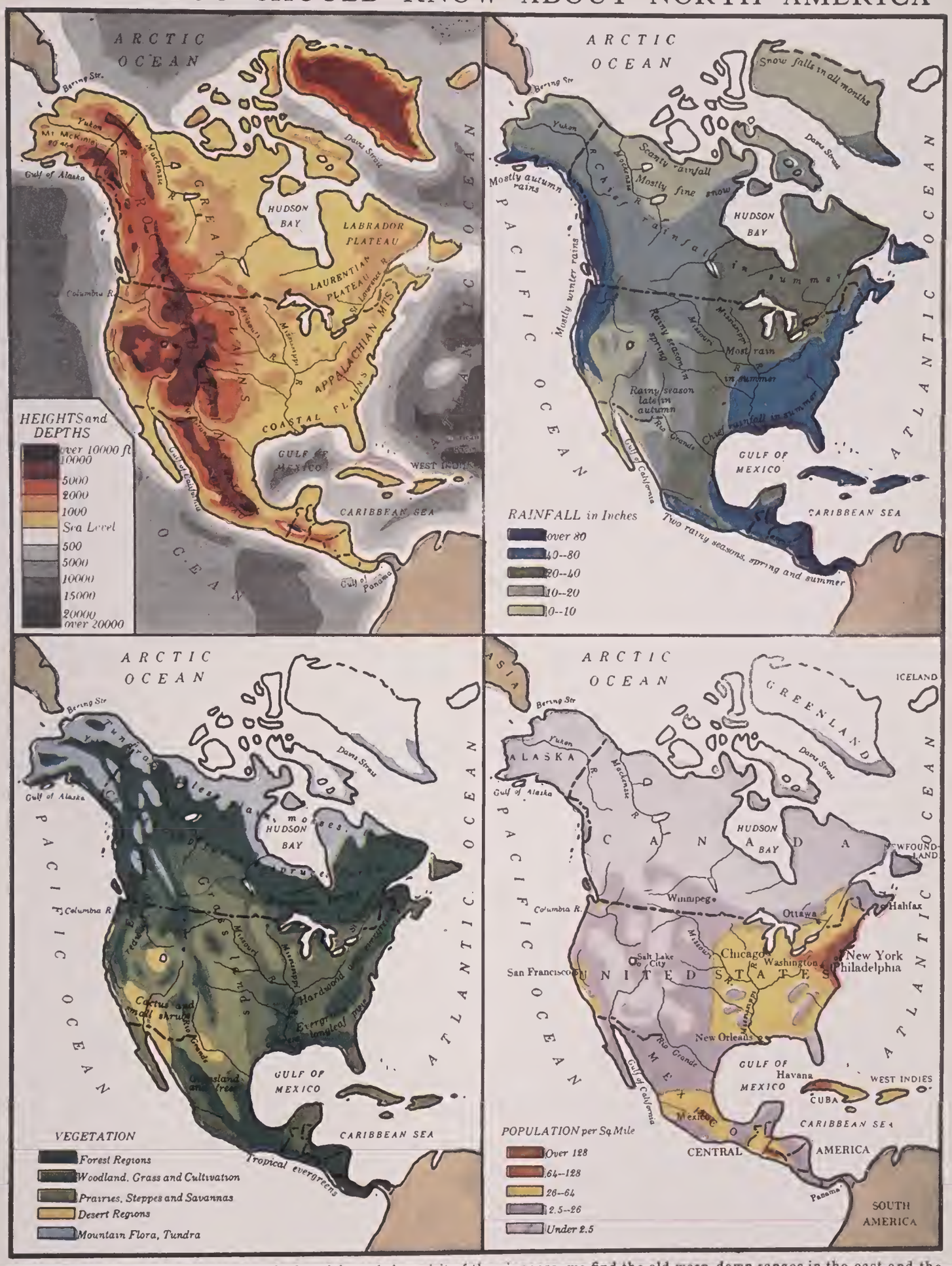
Fortunately, in the temperate zone North America is much nearer to Europe than to Asia, and its discovery and settlement fell to the lot of Europeans. Columbus came and found the tropical West Indies, the threshold of the New World, smiling a ready welcome. Other Europeans followed, and to them the Gulf of Mexico and the Caribbean Sea gave entrance as the Mediterranean does to Europe, and the rich mines of Mexico led to rapid Spanish occupation. Only in Central America would settlement have been easier from the west; for owing to the tropical forests of its eastern lowlands, Central America is most easily penetrated from its mountainous western side.

A Friendly Eastern Coast Line

Settlers from the more northerly European countries were no less fortunate in their landing places. Except where the islands of the Arctic Archipelago stretch into an icy sea, all the many indentations of the American coast were friendly to them. As early as 1500 a fishing colony was established on the island of Newfoundland at the mouth of the great St. Lawrence; and by that stream Cartier and Champlain carried the flag of France far into the heart of the continent. The Dutch sailed up the Hudson River, which is still the chief front door of America; and the English found the rivers flowing into Chesapeake Bay in the south and the harbors of New England excellent gates to permanent colonization. All along the fertile coastal plain, which extends from the St. John River to the Gulf of Mexico, colonies were established and prospered, gradually reaching into the interior.

For any subject not found in its alphabetical place see information

THINGS YOU SHOULD KNOW ABOUT NORTH AMERICA



As if the very mountains themselves had anticipated the spirit of the pioneers, we find the old worn-down ranges in the east and the young lofty mountains in the west. In the upper map on the right you can pick out the well-watered regions and those which are shut off by mountain barriers from the moisture-laden sea winds. The maps below strikingly show how the typical vegetation of the different regions and the relative density of population are in large part determined by these natural conditions. The greatest concentration of population is, as you see, about the seacoasts and the Great Lakes and Mississippi valley regions.

ALEUTIAN ISLANDS
Same scale as main map
172° Longitude East 180° Longitude West 172° from Greenwich 164°
BERING SEA
ALEUTIAN ISLANDS
ALASKA PEN.
UNIMAK I.
SHUMAGIN IS.
FOUR MOUNTAINS
IS. OF THE
UMNAK I.
UNALASKA I.
FOX IS.
ATKA I.
NEAR IS.
RAT IS.
ANDREANOF IS.
ARCTIC OCEAN
GREENLAND
(To Denmark)
GREENLAND SEA
ARCTIC CIRCLE
ICELAND
Akreyri
Diupivoger
Reykjavik
STRAIT OF DENMARK
Christianshaab
Holstenborg
Godthaab
Umivik
C. Farewell
Frederikshaab
DAVIS STRAIT
BAFFIN BAY
Upernivik
DISKO I.
Godhavn
GRANT LAND
SVERDRUP IS.
ELLESMERE ISLAND
Etah
PRINCE PATRICK I.
McClure Strait
Melville Sound
BANKS I.
VICTORIA I.
PR. OF WALES I.
BATHURST I.
NORTH DEVON I.
BYLOT I.
COCKBURN LAND
BOOTHIA PEN.
Gulf of Boothia
Magnetic Pole
MELVILLE PEN.
FOX LAND
SOUTHAMPTON
Hudson Strait
Chidley
C. Farewell
Frederikshaab
Beaufort Sea
C. Bathurst
Pt. Barrow
KEENAN LAND
Lisburne
C. Lisburne
Bering Str.
ASIA
ARCTIC
St. Lawrence I.
St. Michael
Norton Sd.
NUNIVAK I.
Nome
SEWARD PEN.
CIRCLE
Endicott Range
Yukon
Nulato
Tanana
Ft. Yukon
Circle
Fairbanks
Kuskokwim R.
Cook Inlet
Seward
Valdez
Bristol Bay
ALASKA PEN.
SHUMAGIN IS.
Kodiak
KODIAK I.
Gulf of Alaska
Dawson
YUKON
Selkirk
Whitehorse
Skagway
Juneau
Ft. McPherson
Mackenzie R.
Ft. Norman
Great Bear Lake
Ft. Wrigley
Ft. Simpson
Ft. Providence
Ft. Liard
Ft. Rae
Great Slave Lake
Ft. Resolution
Ft. Nelson
Wrangell
Stewart
Prince Rupert
Dunvegan
Ft. McLeod
Ft. Vermilion
Ft. McMurray
Ft. Chipewyan
Churchill
Port Nelson
York Factory
Nelson R.
Churchill R.
COATS I.
MANSEL I.
Unpava Bay
Nain
Hopedale
Rigolet
Cartwright
C. Bald
Melville L.
Hamilton R.
HUDSON BAY
KEEWATIN
NORTHWEST TERRITORIES
MACKENZIE
LABRADOR
CHICAGOF I.
ALEXANDER ARCHIPELAGO
Sitka
BARANOF I.
PRINCE OF WALES I.
Dixon Entrance
QUEEN CHARLOTTE ISLANDS
Prince Rupert
Prince George
BR. COL.
Fraser R.
Edmonton
ALBERTA
Athabaska Landing
Prince Albert
SASK.
N. Saskatchewan R.
Red Deer
Banff
Calgary
Lethbridge
Saskatoon
Regina
Moose Jaw
Lake Winnipeg
Winnipeg
MAN.
Brandon
Kenora
L. of the Woods
Port Arthur
L. Nipigon
ONT.
Albany R.
James Bay
QUE.
BELCHER IS.
ANTICOSTI I.
Gulf of St. Lawrence
NEWFOUNDLAND
St. Johns
Sydney
CAPE BRETON I.
C. Race
Quebec
Montreal
Ottawa
Michipicoten
Cobalt
Sudbury
Sault Ste. Marie
Georgian Bay
Duluth
MINN.
Fargo
N.DAK.
Grand Forks
Bismarck
Missouri R.
Missouli
Helena
MONT.
Butte
Spokane
Vancouver
Nelson
Revelstoke
Kamloops
Victoria
Seattle
Tacoma
WASH.
Olympia
Aatoria
Portland
Columbia R.
Salem
VANCOUVER ISLAND
Juan de Fuca Strait
C. Flattery
Fredericton
N.B.
N.S.
Halifax
St. John
Yarmouth
C. Sable
SABLE I.
ME.
Augusta
Portland
Concord
Montpelier
PACIFIC OCEAN

NORTH AMERICA
SCALE OF MILES
0 100 200 300 400 500 600 700 800
C.S.HAMMOND & CO., N.Y.
UNITED STATES
MEXICO
CUBA
CENTRAL AMERICA
SOUTH AMERICA
GULF OF MEXICO
CARIBBEAN SEA
ATLANTIC OCEAN
PACIFIC OCEAN
TROPIC OF CANCER
BAHAMA ISLANDS
JAMAICA
HAITI
DOMINICAN REPUBLIC
PORTO RICO
WINDWARD ISLANDS
Same scale as main map
Longitude West from Greenwich
108° 124° 116° 108° 100° 92° 84°
Eureka
C. Mendocino
Sacramento
San Francisco
Oakland
Fresno
Santa Barbara
Los Angeles
SANTA BARBARA ISLANDS
San Diego
Ensenada
Reno
Carson City
Great Salt Lake
Salt Lake City
Pocatello
Cheyenne
Denver
Pueblo
Santa Fe
Albuquerque
Phoenix
Tucson
Juarez
El Paso
Hermosillo
Guaymas
Chihuahua
Parral
Lampazos
Torreon
Sinaloa
Culiacan
Durango
Saltillo
Victoria
Tampico
Brownsville
Matamoros
Galveston
Austin
Houston
San Antonio
Waco
Dallas
Ft. Worth
Shreveport
Little Rock
Hot Springs
Muskogee
Tulsa
Wichita
Topeka
Kansas City
Lincoln
Omaha
Des Moines
Mankato
Madison
Milwaukee
Lansing
Grand Rapids
Chicago
Detroit
Pittsburgh
Cleveland
Buffalo
Hartford
New York
Trenton
Philadelphia
Dover
Annapolis
Baltimore
Washington
Charleston
Richmond
Norfolk
Chesapeake Bay
C. Hatteras
Wilmington
C. Fear
Charleston
Savannah
Jacksonville
St. Augustine
Tampa
Miami
Nassau
Key West
Havana
Santa Clara
Camaguey
Cienfuegos
ISLE OF PINES
Manzanillo
Santiago de Cuba
Guantanamo
Kingston
Port au Prince
Santo Domingo
Cape Haitien
Windward Passage
Mona Passage
Gulf of California
Magdalena Bay
La Paz
C. San Lucas
Mazatlan
Tepic
Guadalajara
Guanajuato
Morelia
Colima
Manzanillo
Mexico
Cuernavaca
Puebla
Jalapa
Vera Cruz
Puerto Mexico
Oaxaca
Chilpancingo
Acapulco
Salina Cruz
Gulf of Tehuantepec
Tapachula
Guatemala
Progreso
Merida
Campeche
Gulf of Campeche
Belize
BRITISH HONDURAS
Gulf of Honduras
GUATEMALA
HONDURAS
Tegucigalpa
C. Gracias a Dios
San Salvador
SALVADOR
Gulf of Fonseca
NICARAGUA
Managua
L. Nicaragua
San Juan del Norte
COSTA RICA
San Jose
G. of Nicoya
G. of Dulce
Davids
Panama
Colon
Panama Canal
G. of Darien
Gulf of Panama
PANAMA
VIRGIN IS.
San Juan
PORTO RICO
GUADELOUPE
DOMINICA
MARTINIQUE
ST. LUCIA
ST. VINCENT
GRENADA
BARBADOS
TOBAGO
MARGARITA
TRINIDAD
SOUTH AMERICA
WINDWARD ISLANDS

The first check encountered by American expansion was the Appalachian Mountains, which extend in a long and practically unbroken chain from the Gulf of St. Lawrence almost to the present Gulf States. In these days of steam we are not accustomed to think of these moderately high wooded ridges as barriers, but to regard them rather as storehouses of vast wealth in lumber, coal, and iron, and other natural resources. In colonial days, however, highways were lacking and this back-country was inhabited by Indians who fought doggedly to preserve their hunting grounds. For 150 years the English colonists were thus hemmed in on the seaboard. Nevertheless the nation owes much to the Appalachian barrier. It held together the 13 colonies when they might otherwise have scattered, and thus promoted the sound growth in strength and population which made possible the winning of the Revolution, and after that the organization of the United States.

Great Lakes and Great Rivers

French explorers who penetrated the interior found that the wide St. Lawrence River led to the largest bodies of fresh water in the world, the chain of the Great Lakes. Their great size makes them resemble inland seas, and they have a similar effect upon the climate of the region about them. Not only are they invaluable for transportation, but they lend charm to the surrounding country, and give to eastern America its greatest natural wonder—the Niagara Falls. A short portage from the southern shore of Lake Michigan brought the French explorers to the Illinois River, which carried them down to the mighty stream which the Indians called the "Father of Waters." Whether we consider its drainage, area, volume, length, or navigability, we must grant that this is one of the great rivers of the world. The Missouri and Mississippi together form the longest river on the earth; and with all their tributaries they afford inland navigation for more than 15,000 miles, and drain an area of 1,240,050 square miles.

Nowhere else does a single river give access to such valuable agricultural territory; for no other continent has anything comparable to the vast heart of America, the great fertile plain of the Mississippi valley, broken only by the faint traceries of its winding streams. From the Arctic Ocean to the Gulf of Mexico, one may travel without passing any elevation of more than 1,000 feet above sea-level; for in the middle of the continent the river valley merges with the Great Lakes plain, which farther north blends with the valley of the Mackenzie River, flowing to the Arctic Ocean. At the end of the 18th century the United States and Canada began to push their settlements westward into this great plain; and in little more than 50 years all but the cold northern region was brought under settlement. Numerous railroads connect it with the east, and the Mississippi River, the Great Lakes, and the Erie Canal convey the crops of its fertile lands to the seashore and so to the markets of Europe.

After sweeping over the central plain, the pioneers found themselves confronted by broad plateaus, crested by the many high ranges which are known collectively as the Cordilleras. These chains enter the continent in Alaska, broadening as they pass through Canada, and attaining their greatest width in the United States, where the great table-land is in some places 1,000 miles in breadth. All of Mexico except a narrow coastal plain is a part of this vast plateau, but there the mountains are lower on the whole, and the rainfall is greater. In southern Mexico occurs a break in the long system, known as the Isthmus of Tehuantepec; but in Central America the mountains rise again, fringing the western coast.

This Cordilleran region is the scenic wonderland of America. In Alaska are glaciers more marvelous than those of the Alps; and Mount McKinley, the highest peak on the continent, raises its head almost 5,000 feet above Mount Blanc, the highest mountain in western Europe. The Cascades and Sierra Nevadas which lie near the coast of Canada and the United States present some of the most magnificent mountain scenery in the world; and in the Rocky Mountains is a region of geysers and hot springs, part of which are preserved for visitors in Yellowstone National Park. Farther south lies the "Dead Sea" of America —the Great Salt Lake; and still farther southward, the most wonderful river canyon known to man—the Grand Canyon of the Colorado River. In Mexico and Central America are mighty volcanoes which vomit forth lava, sulphur, and red-hot stones.

Natural Wealth on Every Hand

From Alaska down to the Isthmus of Panama, the Cordilleras contain rich veins of gold, silver, lead, and copper without which it would have been years before men settled this wonderland. No navigable streams lead to the region except the Missouri, and even it will not take one within several hundred miles of the mountain wall. Moreover, the plain country which leads to the mountains is so dry that it did not tempt farmers from the well-watered central valley; and at several places in the central basin are great cactus-covered deserts. In addition, over the whole region roamed tribes of warlike Indians. But as gold had lured men into the mountains of Mexico, so it lured them to the Pacific shore of the United States and Canada, and later to Alaska; and so potent was the charm that in less than half the time it took to conquer the Appalachians, men had crossed deserts and mountains and established their settlements on the far distant Pacific slope.

When man had finally penetrated every corner of this continent, he found few places which could not contribute something to his needs. The only considerable exception is the extremely cold north, where the numerous icy islands of the Arctic Archipelago stretch away to a point only 450 miles from the North Pole. In these low "tundra" regions there is little vegetation, and no considerable animal life except in the sea, from which the Eskimos derive their sole support. On the

whole it has been estimated that the barren lands of North America, including the few desert regions, comprise only two per cent of its entire area. Large areas in northern Canada and Alaska, in addition to the Rocky Mountain and Appalachian regions (in all, one-fifth of the continent) are covered with valuable forests. The semi-arid regions of the west (comprising one-fourth of the entire continent) are at least suitable for grazing. Approximately half of North America is excellent for agriculture, and this proportion is steadily being increased by dry farming and the irrigation of lands which formerly were thought useful only for grazing purposes.

Although North America contains less than one-tenth of the earth's people, it is a land of enormous wealth. It furnishes one-third of the entire world's supply of wheat, two-thirds of its cotton crop, and three-fourths of its corn. Of the precious metals it contributes about one-fourth of the gold and almost two-thirds of the silver of the world; and in the so-called "baser"—though really more precious—metals, its supply is unexcelled. Of iron—the most important metal of all for the uses of man—North America produces about one-half of the world's supply. Its coal deposits are richer than those of any other continent, with the possible exception of Asia; and they furnish almost one-half of the world's coal production. North America also contributes almost three-fourths of the petroleum, and an equal proportion of copper.

This magnificent continent was not always as we now see it, or even as the first white men found it. Millions of years were required to prepare these beds of coal and iron, upon which rests our modern civilization, and to build up the land from which we now get such rich agricultural yields. During these countless ages this firmest land has undergone a vast series of progressive changes, which have left their records in the rocks to be learned by the careful student.

How the Great Continent Rose Out of the Sea

Like other continents, North America consists of a broad fold of the earth's crust, only a part of which rises above the level of the sea. In very ancient times, when this uprising fold first appeared above the surface of the waters, it did not appear as a single united land. The tops of the mountains appeared first, making groups of islands of varied size, like the West Indies. We do not know just where these islands were; but it seems clear that they included the Appalachian Mountains and the Laurentian highland in Canada, and that these first upheavals were followed much later by the Cordilleras. Until comparatively recent geological times the Mississippi valley was entirely under water, forming a sea that extended from what is now the Gulf of Mexico all the way to the Arctic Ocean. In the limestone rock of this region are found many fossil remains of sea animals—shells, corals, and fish—deposited in early times when the land was covered with water.

Gradually, because of the rising of the original islands or the receding of the ocean, the "Mississippi Sea" became more shallow. Wind and rain cut down the mountains, and the sediment which the rivers carried from them filled up this inner sea, forming the deltas and flood plains which are now among the most fertile lands of the country. Finally the various archipelagoes were united into one great land.

Ages after the beginning, when the climate was much warmer and wetter than it is now, occurred what is called the Coal Period. Extensive swamps filled with tall fernlike growths covered much of the continent like a tropical jungle, extending as far north as the Arctic Circle. The land was still in an unstable condition, and after these forests had grown a few hundreds of years, the plains sank beneath the sea, and layers of mud, sand, and gravel collected over them. In time these layers became solid rock, and the vegetation beneath was changed to coal. Then the land rose again and new forests grew, causing one layer of coal to be formed over another. All this time, and at other periods, deposits of iron, copper, gold, and silver were also being laid down. Many minerals were brought by hot water and deposited in cracks in the mountain rock, where they hardened forming what are called mineral veins.

When the Ice Sheet Covered the Land

In more recent geologic times the continent experienced another wonderful change. The climate for some reason became much colder, just as in the Coal Period it was much warmer. A vast sheet of ice appeared in the north, and crept slowly southward, covering a large part of Alaska and Canada, and about one-third of the United States (*see* Ice Age). Thousands of years were required in its slow advance and thousands more for its disappearance; indeed, we may say that we are still in the Ice Age, since remnants of the ice cap still cover the greater part of Greenland and parts of Arctic North America. No one can say why it came, but there are many evidences of what it has done. It scoured the rocks over which it passed like a mighty planer, and swept away the soil that covered the land. It deposited bits of ground-up rock called "drift," which produced a fertile soil in many places; but sometimes it failed to grind up the rock, and then we have bowlders and pebbles, as in New England, which greatly hinder the farmer. Moreover, it blocked up the courses of former rivers, which in finding new paths created waterfalls of inestimable value to manufacturers; and it dug out and left great hollows, which are now the lakes and ponds of northeastern North America. Even our Great Lakes we owe largely to this glacial action.

But the most important work of these millions of years—that which was to have most influence on our climate, and therefore on our crops—was the forming of the mountain systems. The Laurentian and Appalachian mountains, as stated, rose in very early ages; and since then they have been slowly worn away by weather and water. Being low, they allow winds to carry much moisture over them; and since there are no mountains toward the south, winds can also enter

freely from that direction. The lack of barriers toward the north contributes little to the rainfall, but has a considerable effect upon the climate, allowing full sweep for cold waves from the frozen Arctic Ocean. The Cordilleras are younger than the more eastern mountains, and considerably higher. They are, in fact, still growing, as is seen by the earthquakes caused now and again when they crack under the great strain. When winds from the west reach these lofty mountain ranges, they are forced to drop much of their moisture; and when they finally reach the eastern side they have little left. This causes the great plains and plateaus of the western regions to be dry or arid.

Of great importance in its effect on commerce is the fact that the coast of North America is slowly sinking in the north and rising in the south. A sinking coast allows the ocean to enter the lowlands, leaving the higher land to form peninsulas and islands, while the valleys make bays and inlets. Thus on the Pacific coast, north of Seattle, we find a very ragged outline; in the Arctic north are great islands and peninsulas; and on the Atlantic seaboard is a very irregular coast as far south as New York. These indentations have given rise to many important cities on the Atlantic coast, because of the excellent harbors which the submerged river valleys have made. But south of New York and Seattle the dominating movement of recent times has been upward. A large part of the Southern states, bordering on the Atlantic and the Gulf of Mexico, was once part of the ocean bottom or "continental shelf." This shelf is still rising, with the result that there are few good natural harbors on the Atlantic coast below New York, and with the exception of San Diego, none below San Francisco on the Pacific.

"NO'TH CA'LINA," the "TAR-HEEL STATE"

Extent.—North to south, 188 miles; east to west, about 500 miles. Area, 52,426 square miles, including 3,686 square miles of water surface. Population (1920 census), 2,559,123.

Physical Features.—Coast-line protected by barrier reefs, behind which are deep indentations (Albemarle Sound and Pamlico Sound). Coastal plain traversed by Roanoke, Tar, Neuse, and Cape Fear rivers. Piedmont region in west center crossed by Yadkin and Wateree rivers. Blue Ridge and Smoky mountains in the west (highest point, Mount Mitchell, 6,711 feet).

Products.—Corn, cotton, hay, wheat, sweet potatoes, cowpeas, soy beans, tobacco; fruits and vegetables; fish; textiles and other cotton manufactures, tobacco manufactures, lumber and timber products; clay, granite, and other building stone, some iron ore.

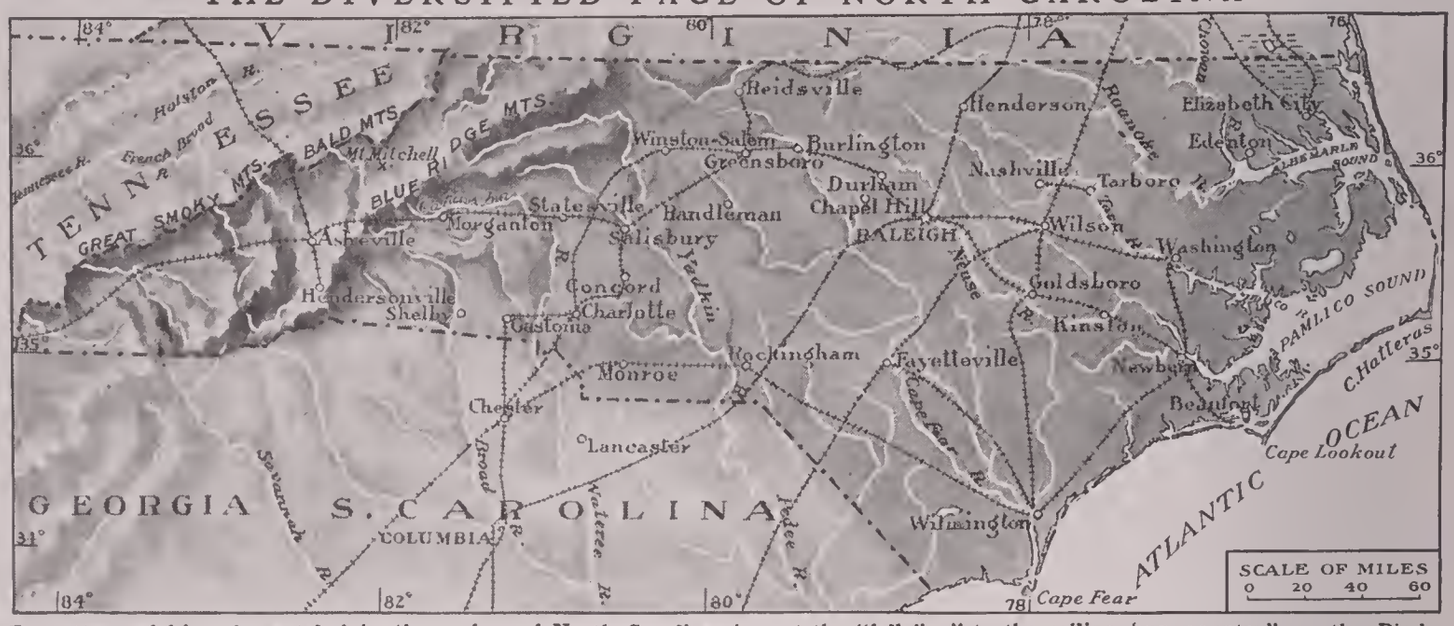
Principal Cities.—Winston-Salem (49,000), Charlotte (47,000), Wilmington (34,000), Asheville (29,000), Raleigh (capital, 25,000).

NORTH CAROLINA. This was the spot in the New World first occupied by England, and here was the birthplace of the first Anglo-American child, Virginia Dare; and North Carolina is still a state where the English-speaking stock is almost untouched by foreign elements. The region is typical of all the New World that was to come under England's rule, for the state holds within its boundaries a bit of almost everything that the whole Atlantic coast possesses. In addition to the low sandy lands visited by the early explorers sent out by Raleigh in 1584, North Carolina possesses the highest mountains of the Appalachian chain, contains many of the minerals of North America (though in small quantities), and almost every variety of tree known to the temperate zone. It is still one of the richest collecting grounds for botanists, and yields all the important crops grown in both the northern and southern parts of the Union. Even in 1584 this diversity of products seems to have existed, for the old account says that the Indians gave to the explorers "divers kindes of fruites, melons, walnuts, cucumbers, gourdes, pease, and divers rootes, and fruites very excellent good, and of their countrey corne, which is very white, faire, and well tasted."

An Italy and Switzerland in One

In climate and soil the "Tar-Heel" or "Old North State" is like Italy, with a touch of Switzerland in its high mountain ranges. In extent east to west it is the longest state east of the Mississippi; in structure it

THE DIVERSIFIED FACE OF NORTH CAROLINA

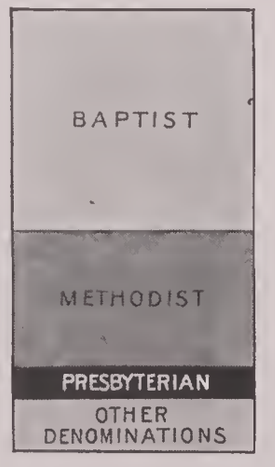


From the reef-fringed coastal plain, the surface of North Carolina rises at the "fall line" to the rolling "up country" as the Piedmont region is here called. From the western end of the plateau region rugged mountain ranges rise abruptly—the largest and highest mountain masses in the eastern United States.

is an incline, sloping from the Smoky Mountains, more than 6,000 feet high, to the level of the Atlantic Ocean, and including in its great length three distinct areas. In the west is a high, cool, picturesque region—a typical resort country, unsurpassed in eastern America for its beauty; a land of springs of pure cold water, of fruits, and of beautiful flowers. As one climbs from the valleys to one of the main peaks one passes successively through the same floral zones that are encountered in traveling from Georgia to southern Canada. The old worn-down mountains are covered with deep rich soil and clothed with massive hardwood forests almost to their tops. Mount Mitchell, with an altitude of 6,711 feet, is the highest peak of the Appalachians, and from its summit seven states can be seen.

This "land of the sky" descends suddenly to the piedmont plateau, several thousand feet below it, where the tumultuous mountains subside into a succession of hills and dales and gently rolling country. This plateau is the great industrial region of the state, and covers one-third of its area. It contains the widest range of agricultural production, and is a growing manufacturing region, especially for textiles, making North Carolina one of the chief cotton spinning and weaving states in the Union. At the "fall line" this "up country" drops abruptly about 200 feet.

Above, the state's products are shown; below, the division according to religious belief.



The whole eastern section consists of the coastal plain, an area of low land which comprises over a third of the entire state. This region has recently become one of the great truck-growing regions of the country, shipping hundreds of carloads of early fruits and vegetables to the great markets of the north every year. On the lowlands of the Cape Fear River, rice has long been an important crop.

North Carolina has two coastlines, an inner coast deeply indented by Albemarle and Pamlico sounds, and an outer line formed by a chain of long narrow sand reefs, from which project Cape Fear, Cape Lookout, and Cape Hatteras. The last-named is noted for its frequent and dangerous storms, due in part to the meeting of the warm winds from the Gulf Stream with the cooler land breezes. Outlying shoals are very dangerous to navigation and the many shipwrecks which occur here have led to the establishment of two government lighthouses to warn mariners from the spot. Shad and herring fisheries on the coast are very valuable and the oysters and other shell fish found are of fine quality.

North Carolina is still a great agricultural state, ranking among the first six states in the value of its crops. Corn, the leading crop, is grown in every county. Cotton is second in importance, and a few counties are unexcelled in its production, although the state is on the northern limit of the

For any subject not found in its alphabetical place see information

PRIZE WINNERS FROM NORTH CAROLINA FARMS

In this picture you get a fine survey of the agricultural products of North Carolina soil at their best, for these are prize-winning exhibits at one of the state fairs. The soy beans and rice are labeled for you, but can't you recognize most of the others—melons, squashes, grains, and apples and other fruits?

cotton belt. In the production of tobacco North Carolina shares the first place with Kentucky, and it is a large producer of sweet potatoes. Truck farming and grape culture have largely increased with recent years.

This is the light yellow North Carolina tobacco of which cigarettes are made. It thrives in the loose sandy soil so common in this state.

But North Carolina is not only an agricultural state, although a generation ago it might have been so described. During the past few decades it has experienced such a phenomenal industrial growth that it now ranks among the leading manufacturing states of the South. It has more cotton factories than any other state, and in the value of its cotton products (cotton yarn, hosiery and knit goods, plain cloths, ginghams, etc.) it is second only to Massachusetts. One reason for this tremendous development is the vast water-power created by hundreds of mountain streams and waterfalls, which, it is estimated, could manufacture twice the entire cotton crop of the South. At present North Carolina manufactures practically all the cotton produced within its borders, and ranks high also in cottonseed products. Other great industries have grown with almost equal rapidity. To its fame as a tobacco grower North Carolina has added a reputation as a manufacturer of tobacco products, produced chiefly in Durham and Winston-Salem, which are known as far as the Ganges and the Nile. The forests which cover much of the state have not only attracted numberless saw mills, but have created large furniture factories, especially at Highpoint, which has one of the largest outputs of furniture in the Union.

These are settling pits at a kaolin mine. After the clay has been mixed with water to remove the sand, it is put in these pits to settle.

Immense quantities of turpentine, resin, tar, and pitch are produced from the pine forests—a fact which accounts for the nickname sometimes used for the state, the "Tar-Heel State." The great increase

WHERE THE MOUNTAIN STREAMS COME DOWN TO WORK

Here's one of those big cotton mills that change the products of the cotton fields into white cloth. Not only does North Carolina manufacture all her own cotton, but there is enough water power in her mountain streams and waterfalls to manufacture twice the cotton crop of the entire South!

in the number of factories has brought a new emphasis on the problem of better schools and child labor laws.

Minerals are found in great variety, but not in important quantities, except the valuable kaolin clay from the western counties. Up to the discovery of gold in California, North Carolina was the largest gold-producing state in the Union. The chief minerals now produced are mica and iron. Coal, gold, and silver are also mined. The quarries yield granite, limestone, and excellent marble.

Less than a quarter of the people live in cities. The largest city is Winston-Salem, with its extensive tobacco factories. Charlotte is the center of the cotton-mill industry. Wilmington, near the mouth of the Cape Fear River, is an important commercial city and also a manufacturing center. Raleigh, the capital, popularly called "The City of Oaks," commemorates the name of the state's founder. It has important manufacturing establishments, being in a rich cotton and tobacco district. Chapel Hill, the seat of the University of North Carolina, is 28 miles northwest of Raleigh. Asheville, widely famed as a winter and summer resort, is situated in the heart of the mountain section, surrounded by impressive and charming scenery.

English colonization of the New World began with the expedition sent out by Sir Walter Raleigh in 1584, which explored the Carolina coast between Pamlico and Albemarle sounds. Its favorable report led

WHERE YOU MEET THE PLANT PEOPLE

Wouldn't it be delightful to get acquainted with the people of the plant world and all their wonderful and pretty ways in a place like this? That's just what you would do if you were studying botany at the University of North Carolina; for this is a corner—only a corner—of the Arboretum, and an arboretum, your dictionary tells you, is "a place where trees and shrubs are cultivated for scientific or educational purposes."

For any subject not found in its alphabetical place see information

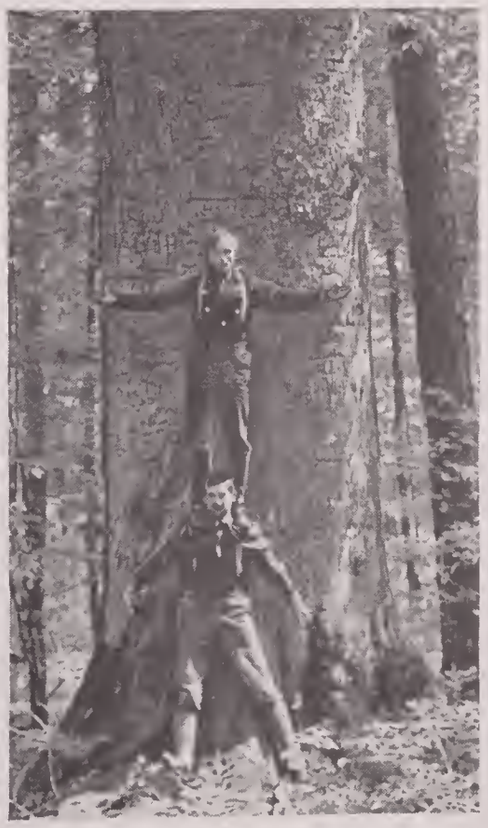
A PLEASANT LIFE IN THE MOUNTAINS

Being a "mountaineer" and living in such a place as this might be called, in the language of an American humorist, "roughing it de luxe." This is one of the fine hotels in Asheville, the famous winter and summer resort of North Carolina.

Raleigh to send out a colony next year, which settled on Roanoke Island; but conflicts with the Indians soon led the settlers to return. In 1587 Raleigh sent out his second colony under John White as governor. Governor White's granddaughter, Virginia Dare (born Aug. 18, 1587) was the first English child born in America. The fate of this "lost colony" is one of the unsolved problems of history; for when Governor White returned to Roanoke, after three years' absence in England to obtain supplies, the settlers had all disappeared, including his daughter and little granddaughter. The word "Croatoan" carved on one of the trees proved a useless clue.

This is the North Carolina State Capitol at Raleigh. It is a substantial granite structure built in colonial style.

Colonization of the region under a grant from Charles I (in which the name "Carolina," from the king's name, was first used) was no more successful. In 1663 Charles II granted the region to a group of "lords proprietors," who divided it into North and South Carolina, drew up a code of fantastic feudal regulations, and made some progress in settlement. In 1729 North Carolina became a separate royal province. In the first part of the 18th century Scotch-Irish and German settlers began to come into the back country from Pennsylvania, and after 1746 a number of settlers were deported to North Carolina from Scotland. At the time of the Revolution the population had grown to about 300,000. A provincial congress in 1774 sent delegates to the first Continental Congress, and the state took an early stand for independence. It refused, however, to ratify the Federal Constitution until after the adoption of the first ten amendments, in 1790. The western parts (now the state of Tennessee) which had attempted to form the "State of Franklin" were finally ceded to the Federal government in that same year. The capital was established in Raleigh in 1791, and the state university opened in 1795.



These two men doing their circus "stunt" will give you an idea of the size of some of North Carolina's forest giants.

North Carolina did not secede from the Union and join the Confederacy until 1861. It was the last battle-ground of the Civil War, which ended with the surrender of Johnston to Sherman, at Durham's Station, on April 26, 1865. North Carolina suffered much under the rule of "carpet-baggers" during reconstruction, but in 1870 this unhappy period closed and the state has since gone sturdily forward. In 1915 the state adopted the direct primary for all nominations.

The WHEAT-CLAD PLAINS of NORTH DAKOTA

North Dakota's Crop of Spring Wheat is by far the Largest in the United States

Extent.—East and west, 360 miles; north and south, 210 miles. Area, 70,837 square miles. Population (1920 census), 645,680.

Rivers and Lakes.—Red River of the North (forming eastern boundary) and its tributaries, the Pembina, the Goose, and the Cheyenne; the Dakota or James River; Mouse, or Souris; Missouri and its tributaries, the Little Missouri, Cannon Ball, the Heart, and the Knife. Devils Lake and numerous small lakes.

Mountains.—Pembina Mountains (escarpment of low wooded hills in the northeast); Turtle Mountains (highest point, 2,400 feet) in north central part of the state; Coteau du Missouri separating southwestern plateau half of the state from the eastern plains; numerous isolated Buttes (Black Butte, 3,468 feet) and "bad lands" in western half.

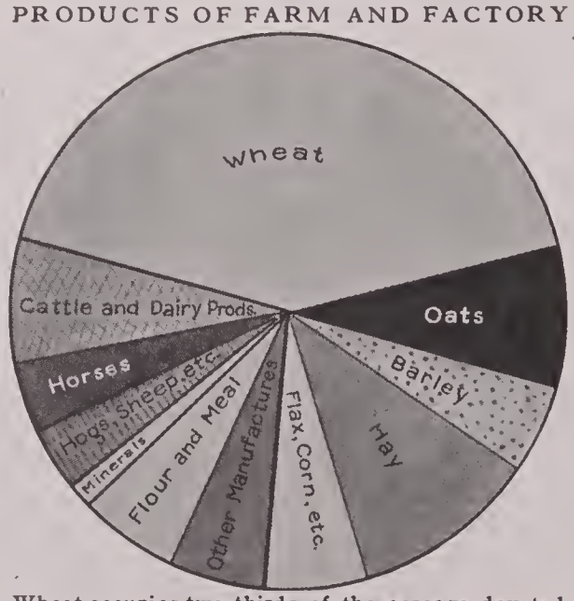
Products.—Wheat, oats, barley, rye, hay, potatoes, flaxseed; cattle, horses, wool, dairy products; coal, clay (largely manufactured into pressed brick), lignite.

Cities.—Fargo (22,000), Grand Forks (15,000), Bismarck (capital), Minot, Dickinson, Jamestown, Valley City, Devils Lake.

NORTH DAKOTA. As large as New York, Massachusetts, Connecticut, and New Jersey put together, but with a population less than that of Brooklyn—a big land of vast open plains and fertile prairies, yielding abundantly, but with resources not yet fully developed—North Dakota is a forward looking state with brilliant prospects for further growth and progress.

Lying partly in the Prairie Plains region, and partly in the Great Plains, North Dakota consists of three vast terraces rising one beyond the other, from east to west. The most eastern and the lowest of these is the famous Red River valley, which begins in Minnesota, extends through North Dakota, and as far north as Lake Winnipeg in Canada. To the west of this is a slightly higher plain, which however contains one group of hills, the Turtle Mountains in the north. This plain reaches to the Coteau du Missouri, a great ridge or escarpment extending diagonally from northwest to south parallel to the Missouri River. Beyond this is the third terrace, a plateau rising to a height of more than 3,000 feet in the southwest, and occupying about half the state.

PRODUCTS OF FARM AND FACTORY



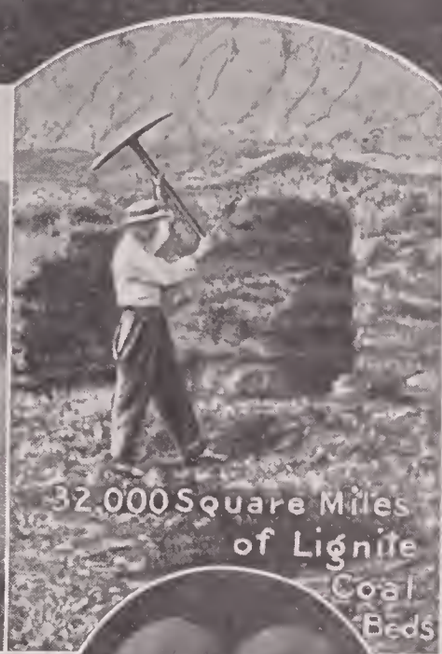
Wheat occupies two-thirds of the acreage devoted to cereals, and represents two-thirds of the value of all cereals combined, as well as nearly one-half of the value of all farm products.

The monotony of the treeless prairies that cover the greater part of the state is broken by many rivers and small lakes. The large salt lake, called Devils Lake, is a favorite vacation spot. Its irregular banks are clothed with trees, and its briny waters, which resemble the ocean in both appearance and taste, make possible the unexpected delight of "sea-bathing" in this far inland region.

Still more unusual is the scenery in the unglaciated southwestern part of the state—the so-called Bad Lands. Here the rains and winds of centuries have carved the sandstone into grotesque peaks and oddly shaped pinnacles, and to make them still more fantastic, fires sweeping over the extensive beds of lignite coal have burned and baked and melted the surface soil and helped to give it the weird colors which we see—blues, reds, browns, yellows, purples, and grays. Seen against the bright blue of a clear Dakota sky, these fantastic buttes present a strangely beautiful picture. Here one finds wonderful "paint rocks" of various colors, which need only the addition of water for use. The early pioneers called this region the Bad Lands because it was so difficult to traverse. In other respects it hardly deserves the name, for even here the valleys are fertile, and cattle graze peacefully at the foot of these strange rock formations. To compensate the farmer for any difficulty he may have, he is able to dig from the hillsides his own fuel in the shape of lignite or brown coal. This may be mined almost from day to day as he needs it.

For any subject not found in its alphabetical place see information

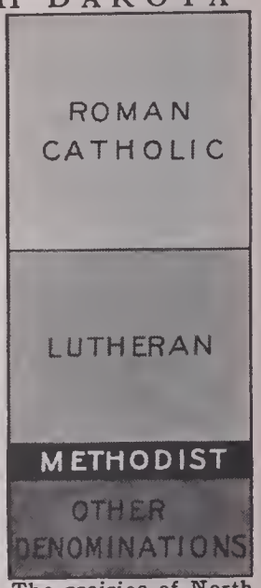
HOW NORTH DAKOTA GETS WEALTH FROM ITS SOIL



North Dakota is practically one great plain—and from this plain the enterprising inhabitants of the state bring a wealth of products to feed the nation. North Dakota's wheat, of course, is world-famous; and the state furnishes great quantities of flax, and a fine grade of potatoes, as well as dairy products and general farm produce. The state has valuable lignite coal beds, while the unplowed prairies support sheep and cattle.

contained in the Easy Reference Fact-Index at the end of this work

THE VAST PLAINS AND RIVER VALLEYS OF NORTH DAKOTA



The prairies of North Dakota have become one of the most famous wheat growing regions of the world. Almost any part of the state can be made to yield abundantly by simply turning over the rich loam.

About 32,000 square miles in the western part of the state are underlaid with this half-made coal, which was once considered of little worth, but which is now revealing greater and greater possibilities of usefulness as a source of heat and power. By proper treatment this lignite can be made into briquets which rival anthracite coal in fuel value, besides yielding valuable by-products such as gas, oils, and tars. Close to this supply of cheap fuel are various kinds of clay of the highest grade, used extensively for pressed brick and fire-brick, and suitable also for pottery. Although still largely confined to the industries of agriculture and cattle-raising, North Dakota has prospects of becoming a manufacturing state as well.

"BAD LANDS" THAT AREN'T SO BAD AFTER ALL!

In the southwestern portion of North Dakota are picturesque regions like this, where the soil has been carved deep by the winds and waters of ages. Although they are called the "Bad Lands," the valleys of this region are extremely fertile and the smoother ranges provide excellent grass and winter shelter for cattle.

Moreover, few states in the Union have a larger percentage of tillable land than North Dakota. The black loam which has made possible the great wheat fields of the Red River valley and has caused this region to be known as "the bread-basket of the world" is the richest of all; but there is scarcely any portion of the state that cannot be cultivated by merely turning the ground with the plow. Most of the soils are rich fine-textured loams, with all the mineral elements necessary to plant life and a large capacity of storing moisture. Nearly all of the rainfall occurs during the growing months of May, June, and July. The summers are mild and delightful, and ideal for growing crops. The winters, however, are cold, the thermometer often going down to 40 degrees below zero, and sometimes lower. But the cold is not felt as it would be in a damper atmosphere; the dry clear air makes it healthful and invigorating.

The great crop of North Dakota is wheat. The quality is very high, and as many as 100 million bushels are produced in a single year. In the production of spring wheat, which is the variety best adapted to climatic conditions, North Dakota leads all the states in the Union. The wheat is sown during tne month of April and requires no further attention until harvest. Winter rye, in which this state also ranks first, though the crop is not so valuable, is often planted on the same land as soon as the wheat is harvested. Oats rank next to wheat in the number of bushels produced, and about half

the flax grown in the country is produced in North Dakota. Barley, corn, hay, and potatoes are very important crops, and when planted in rotation with wheat help to keep the soil from becoming depleted.

There was a time when great cattle and sheep ranches covered a large part of the state. Now most of these have been cut up into farms; but the abundance of nutritious natural grasses, and the ease with which alfalfa and other feeds can be grown, still make North Dakota a big stock-raising state. Dairying is also an important industry.

THE STATE CAPITOL AT BISMARCK

Bismarck is situated on the east bank of the Missouri River in the south-central part of the state. The Capitol is the most prominent building of the city.

North Dakota has a large rural population; more than 80 per cent of the people live in the country. There is not a single large city in the state. Bismarck, the capital, contains less than 10,000 people, and, as travelers have often remarked, from any corner one can look out upon the open country. Fargo, the largest city, 22,000 people, looks very citified for its size and has flourishing commercial and manufacturing industries.

Although the majority of the people have always been farmers, it is only in recent years, as the big farms have been broken up and their owners have become less isolated, that they have learned to work together and have come to exercise a controlling power in politics. About 1911 a movement began which led, in 1915, to the organization of the National Non-Partisan League, composed of farmers and workingmen. Its success in securing control of the state government, and its novel legislation in the interest of its farmer citizens—soundly "progressive" or "radical" according to one's point of view—attracted the attention of the whole country. Although the program of the League aroused much criticism from opponents, its influence spread to several neighboring states.

A first step in realizing its economic program was the passing of an amendment to the state constitution so as to permit the state to engage in any kind of business in the interest of its citizens. Then state-owned terminal elevators and flour mills were established to secure fairer treatment for the farmer, together with coöperative stores, hail insurance, a system of rural credits, and a state bank in which all public funds of the state must be deposited. Improvements on farm land were exempted from taxation, and unused lands were heavily taxed to force them into productive use. These are some of the most outstanding features of an economic program which, in many respects, is the most far-reaching adopted by any American state.

Since North Dakota is so largely a rural state, it is the rural schools that form the foundation of the educational system, and great pride has been taken in making these schools as efficient as possible. In most parts of the state there are consolidated schools, to which the boys and girls are given free transportation, and in which they enjoy the same advantages as do children in the city schools. North Dakota ranks low in percentage of illiteracy, only about three per cent of the people being unable to read and write. About 70 per cent of the people are foreign born or of foreign descent, mostly Scandinavian. Among the institutions of higher learning are the State University at Grand Forks, the Agricultural College at Fargo, the normal schools at Valley City, Mayville, Minot, Dickinson, and Ellendale, a School of Forestry at Bottineau, and a State School of Science at Wahpeton.

The old territory of Dakota, which included North and South Dakota, took its name from the Indian name ("Dakotas" meaning allies) for the Sioux Confederation whose members once roamed these plains. It was a part of the Louisiana Purchase, was organized as a territory in 1861, and in 1889 was divided and admitted into the Union as the two states, North and South Dakota.

NORTHMEN. In their long, shallow, black boats, with sides hung with round shields and with high-curved prows carved in the form of a snake or dragon, the bold Vikings of the north scoured the known and unknown seas in search of adventure, conquest, and booty. Tempted by stories of rich lands to the south, they left their homes in Norway, Denmark, and Sweden and ravaged the coasts of Europe, from England and France in the north to Italy and Greece in the south. Their boats sailed up the rivers, spreading destruction and terror through the land. Their invasions were the last wave of the Teutonic conquests which began with the Goths and Vandals five centuries earlier. So feared did their piracies

become that a special prayer was offered in the churches, "From the fury of the Northmen, good Lord, deliver us."

This state of terror lasted many years, from the 9th to the 11th centuries. Three times Paris fell before the invaders, and was only saved the fourth time after a siege of 13 months by the courage of brave Count Odo. At last Charles the Simple, king of France, concluded a peace with Rolf (or Rollo), the leader of the Northmen (in 911). By it the Northmen were allowed to settle in a rich section of northern France on both sides of the mouth of the River Seine, where the leader became a vassal of the French king. The name Normandy was given to the district, and the Northmen who lived there were called Normans. The Normans adopted the language of the French and gave up their heathen rites for the Christian religion. Under the stern rule of Duke Rolf and his successors they soon became quiet industrious tillers of the soil. It is said that before Rolf died, "gold rings could be hung from the trees and no one would touch them."

If the Northmen had been merely pirates their story would have been quickly told. But they had in them enduring qualities, which still live in their descendants. They were hardy, enduring of cold, toil, and hunger, energetic, and possessed of courage which was proof against any danger. They even braved the terrors of the supernatural and sailed far out into the uncharted seas, steering their course by the sun and stars. In spite of the possibility of a "jumping-off place," they ventured across the Atlantic more than four centuries before Columbus was born. Their chief characteristic was this love of the sea. When a Viking chieftain died it was the custom of the Northmen to place his body on his boat with solemn ceremonies. Then the master and the ship were cast adrift upon "the pathway of the swans."

WHEN THE NORTHMEN WENT TO WAR

In their long, shallow, black boats with high curved prows shaped into snakes and dragons, the bold Vikings of the north scoured the known and unknown seas in search of adventure, conquest, and booty. At times, also, they fell out among themselves, as in the scene pictured here. War was one of the delights of life to the Northman. The only thing he dreaded was that he might die at home of some peaceful sickness instead of in the excitement of battle.

Most notable of the exploits of the Northmen was their discovery of America, about the year 1000. Iceland was settled by them as early as 870; and about a century later a leader named Eric the Red, forced to flee from that island because of a homicide, led a colony of settlers from Norway to Greenland (about 985). His son was the famous Leif Ericsson, who in the year 1000 discovered some part of northern North America and named it "Wineland (Vinland) the Good." The story, which is preserved to us only in the old songs or "sagas," tells how Leif was driven out of his course for Greenland by contrary weather, and came to a land where there were maple trees, and self-sown wheat, and wild grapes (but some think these were cranberries). One of the party, a German, who wandered from the rest, discovered the possibility of making wine from the fruit. Apparently Leif's landfall was on the coast of Nova Scotia. Two years later Thorfinn Karlsefni led an expedition of three vessels and 160 men (including women) to Vinland, and wintered there. But the hostility of the fierce natives (called "skraelings" in the accounts), together with

THE NORTHMAN WHO FOUNDED THE RUSSIAN EMPIRE

When the Russian tribes of the 9th century found themselves involved in constant quarrels, tradition says that they called upon the Northmen to restore order. In response came Rurik the Oarsman, and his two brothers, Sineus and Truvor—all bold sea-rovers. They put an end to Russian disputes by conquering the land from the Gulf of Finland to the Volga, establishing their capital at Novgorod. After Rurik's death in 879, his descendants held princely sway in Russia until the end of the 16th century.

contained in the Easy Reference Fact-Index at the end of this work

internal dissensions, led to the abandonment of the colony. The fact that these European adventurers did not have the advantage over the natives which firearms gave to Columbus and later explorers is one explanation why nothing in the way of permanent connection came of these early Northmen discoveries.

In Europe one of the Northmen, named Rurik, with his followers, first consolidated the Slavs of western Russia into a single great kingdom, and his dynasty ruled Russia for more than seven centuries. Others of these restless warriors found employment as mercenary troops under the emperors at Constantinople, where they formed the backbone of the famous Varangian guard.

NORTH SEA. Upon entering the English Channel even the sturdiest passenger on the largest liner—though he may have crossed the whole Atlantic without a qualm—usually prefers to keep close to his cabin or his steamer chair; for the North Sea, of which the English Channel is the southern arm, is one of the roughest in the world.

Shallow seas are likely to be rough. The average depth of the southern portion is only about 100 feet; toward the middle it reaches 250 feet, and in the north, 400. In places it is shallower still. Indeed we should have to go back only a few thousand years to find this region dry land; for it was comparatively in late geological times that this sea was formed when the Atlantic first swept over the plains which had formerly joined the British Isles to the mainland.

The Dogger Bank, a great sandbank 170 miles long by 60 wide in the center of the sea between England and Norway, is only 50 to 100 feet under water. The only really deep places are to the north, in the Norway Deep, which sheers off to 1,000 feet 20 miles from shore, and to over 2,400 feet at the entrance to the Skagerrack. This arm, the most notable of the many fiord, bay, and estuary formations that indent the shores of the North Sea, separates Norway from Denmark and connects through the Kattegat with the Baltic Sea.

You could lose 180 North Seas and more in the Atlantic Ocean, for its area is only a little over 190,000 square miles, not much more than that of the Caspian Sea. Its greatest length from the Shetlands and the southern coast of Norway to the Straits of Dover is only 600 miles, its greatest width, between Haddingtonshire (in Scotland) and Denmark, is 420 miles, and the distance from Calais to Dover is only 21 miles. Yet this little sea has been the theater of more battles and shipwrecks than almost any other sea in the world. Its navigation has always been treacherous, and even in our own day, when every shoal, sandbank, and submerged rock is known, shipwrecks are not infrequent. At the southwest angle there is a great junction of traffic where the mouths of the Thames, Scheldt, Meuse, and Rhine converge; and all the way from Calais to Christiania are the harbors and river ports of England, France, Belgium, Germany, Holand, Denmark, and Norway.

Fishermen as well as vessels of commerce brave the wild waves and the turbulent winds of the North Sea, for here lie some of the richest fishing grounds in the whole world. The shallow waters are full of the lower forms of animal and vegetable life that attract fish. The bays abound in oysters, crabs, lobsters, shrimps, small fish, and mussels, while from the open waters the fishermen draw in nets or on lines salmon, turbot, plaice, sole, cod, mackerel, herring, halibut, and haddock. Whales, dolphins, porpoises, seals, and sharks also wander into the North Sea waters.

The North Sea was the chief theater of naval operations during the World War. All the most important engagements were fought within its limits. Thousands of mines were laid by both sides. The United States had the chief part in laying a barrage of mines 230 miles long from Norway to Scotland to bar the path of German submarines.

NORTHWEST TERRITORIES, CANADA. About one-third of all Canada is comprised in the huge wilderness known as the Northwest Territories. This consists of a plain stretching north from the prairie provinces to the Arctic Ocean, and continued by the great group of islands, the northernmost of which extends to within 475 miles of the North Pole.

The entire population is estimated at only about 18,000, mostly Indians, half-breeds, and Eskimos. There are no towns, but a few white people live at the trading posts of the Hudson's Bay Company (*see* Hudson's Bay Company). The furs of the countless wild animals that roam over the forested area support the only industry, for although gold, copper, coal, and petroleum are known to exist, the difficulties of production are too great for profitable development. Most of the area is still unexplored, and must remain forever uninhabitable for white men because of the severity of the climate. About half is comprised in the great treeless plain known as the Barren Lands. In the west, along the valley of the Mackenzie River, however, the soil is fertile and the climate somewhat more moderate, so that vegetables and hardy cereals are raised at the trading posts.

Until 1869 all the region was part of the immense possessions of the Hudson's Bay Company. It is administered by a commissioner appointed by the government of Canada and by the Royal Northwest Mounted Police, and is divided into the provisional districts of Mackenzie, Keewatin, and Franklin.

NORTHWEST TERRITORY. When the 13 American colonies won their independence from England, six of the old states, on the basis of their old sea-to-sea grants, claimed sections of the great unsettled regions between the Allegheny Mountains and the Mississippi River. But Maryland, which had no western lands, felt "that the back lands, claimed by the British crown, if secured by the blood and treasure of all, ought in reason, justice, and policy to be considered a common stock." So she refused to ratify the Articles of Confederation until the other states had given their western lands to the Federal government.

Having acquired this territory, Congress had next to devise some means for governing it, and in 1787 an ordinance was passed which has been declared to be second in importance only to the Declaration of Independence and the Constitution. It provided that the region should be divided into not less than three or more than five states; that it should be governed at first by officers appointed by Congress; that after it had 5,000 free male inhabitants a house of representatives should be elected, which could select a delegate to Congress with the right to debate but not to vote; and that when any of the divisions of the territory had 60,000 free inhabitants it should be admitted to the Union "on an equal footing with the original states." The law also allowed freedom of religion, habeas corpus privileges, and jury trial. It declared that "schools and the means of education shall be forever encouraged," and finally, it prohibited slavery in the region "northwest of the river Ohio." The means of encouraging education had already been provided in an ordinance originating with Jefferson in 1785, which provided for the survey and sale of the land, and for the giving of $\frac{1}{36}$ of the national domain to the new states for the support of public schools.

The plan of government worked out by Congress for this region was followed in all later "territories" of the United States. Out of the original Northwest Territory were carved the states of Ohio, Indiana, Illinois, Michigan, and Wisconsin.

NORWAY. Land of the midnight sun, of still summer twilights that last until dawn, of snow-capped mountains, glaciers gliding to the sea, and mountain lakes as clear as crystal; of tumbling waterfalls and rushing rivers, of high pastures with cowbells tinkling among the precipices and deep valleys edged with somber pines and glistening birches; of fiords, placid and smiling or dark and threatening, whose beauty defies description—such is Norway, land of the Vikings of old, a very paradise for winter sports or summer tramps or cruises!

Norway (in the Norwegian language, "Norge") is the northwestern part of Scandinavia, that great peninsula which appears on the map as a dragon's head stretching out from the mainland into the northern seas of Europe. The dragon's mouth seems to partly open toward the south, where the Skagerrack, an arm of the North Sea, cuts into the land to form two smaller projections, the southernmost parts of Norway on the one hand, and of Sweden on the other. Extending northward and eastward from here, a great ridge of mountains, chief of which are the Kiolen or Keel Mountains, forms a barrier between these twin countries and covers most of the surface of Norway, making it one of the most distinctly mountainous countries in Europe. These highlands, however, are rather a group of elevated plateaus than a system of mountain chains, grooved by many deep valleys cut during the Ice Age by the overwhelming march of glaciers.

But even more rugged and irregular than the surface of the land is its coast-line—its cliffs broken

by innumerable fiords, and bordered by a fringe of about 150,000 rocky islands. If we were to measure all around these indentations and islands, we should find the coast-line to be about 12,000 miles, long enough to extend nearly halfway around the earth, and more than ten times the length of the country from the southwest to the northeast. We might expect to encounter violent storms along such a rough coast, but within the *skjaergaard* or "island - fence" the waters are comparatively smooth.

A COUNTRY SCHOOL HOUSE IN NORWAY

The hardy Norwegian boys and girls enjoy outdoor life immensely, but they also have keen appetites for things that books can tell them. This is a country school house among the rugged hills of the North.

Although Norway extends almost 300 miles into the Arctic zone, and nearly a third of the entire country is in the domain of the midnight sun and the winter darkness, the climate on the west, tempered by the warm winds from the Atlantic, is far milder than one might expect. Only on the east coast and among the central mountains is the cold severe. The winters, however, are long. In the same latitude in which lie the almost uninhabitable Arctic regions of America and of eastern Siberia, the waters of the western fiords, warmed by the gulf stream drift, never freeze except in their upper extremities.

If we arrive at Christiania, the capital and largest city (*see* Christiania), in February, we shall find the national winter sport of skiing at its height. The hills and mountains about the city, now covered with snow, are the pleasure ground for the entire populace, who with their skis or their sleds make their way to the top of Holmenkollen Mountain to come shooting back at lightning speed over the five-mile course from the very top of the mountain to the long level stretches of the foot-hills. And on Holmenkollen Bay when the ski-jumping contests are held, all the shops are closed and at least 40,000 enthusiastic spectators will be found on the mountain-side north of the city. Another famous sporting center is Finse, which lies in the great snow-fields, 4,000 feet above the sea, half a day's journey by rail from Christiania. Here reindeer-drawn sleds meet one at the railroad and skiing may be enjoyed the year around.

With the approach of summer we may follow the popular custom of tourists, strap our knapsacks on our backs and start out on a walking trip through one of the many lovely valleys in central or southern Norway. It is hard to imagine a more pleasurable way of spending a vacation than this, with healthful exercise in the invigorating climate among surroundings of surpassing loveliness. The roads are excellent, in many places tunneled through the solid rock, or with overhanging crags beside a raging torrent; the scenery is ever-changing and interesting; and good accommodations and food may be had at reasonable prices at the little posting stations and in inns along the route. The people are friendly and hospitable, thoroughly reliable and honest, and many of the better educated Norwegians speak English fluently.

The valleys are the chief agricultural regions, which comprise less than four per cent of the total area.

CHIEF FACTS ABOUT NORWAY

Extent.—Southwest to northeast, about 1,100 miles; east to west, 60 to 250 miles. Area, about 125,000 square miles; coast-line, including fiords and islands, about 12,000 miles. Population, about 2,695,000.

Physical Features.—Surface a rugged table-land, with numerous isolated mountain masses, snow fields, and glaciers. Chief ranges: Kiolen (Keel) on border between Norway and Sweden (highest point, Jaeggevarre, 6,283 feet); Dovre Fjeld (Snehaetta, 7,615 feet); Rjondane Fjeld (Högronden, 6,929 feet); Jötun Fjeld or Jotunheim (Galdhöpiggen, highest mountain in Scandinavia, 8,399 feet). Largest glacier in Europe, Jostedalsbrae (area, 580 square miles). Principal fiords: Christiania, Bukken, Hardanger, Sogne, Nord, Trondhjem, Geiranger, Vest (West), Lyngen, Varanger. Chief rivers: Glommen, Drammen. Numerous lakes.

Products.—Oats, barley, rye, wheat, potatoes; cattle, sheep, and dairy products; cod, herring, mackerel, and other fish; whale oil; iron, copper, nickel, silver; lumber and timber products, chemicals, paper, and food products.

Principal Cities.—Christiania (capital, about 260,000); Bergen (more than 90,000); Trondhjem (about 55,000); Stavanger (more than 46,000).

WHERE EUROPE REARS ITS RUGGED HEAD

The great Scandinavian peninsula, which includes Norway, Sweden, and a bit of Lapland, forms the northern tip of Europe, reaching far up into the Arctic Circle. Notice the saw-tooth coast of Norway, the most rugged and broken stretch of sea-board in the world. The map shows how the great schools of food fish—cod, mackerel, and herring—make their haunts in the cold waters which wash this rock-bound shore.

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The Saetersdal, in the extreme north, is particularly interesting because, owing to its being far removed from the railroad, it is one of the few places in Norway where the inhabitants still cling to their old habits and peasant costumes.

The farmsteads all over Norway are built of timber and comprise four or more separate buildings surrounding an open square. Of these buildings the *stabbur*, or storehouse for food, is picturesque, with a bell-tower, broad overhanging eaves, and with piles at each corner which raise the building several feet off the ground. Frequently the buildings are thatched with sod, in which grass and flowers and even small trees grow, so that it is not an uncommon sight to see the nimble mountain goats grazing on the low steeply pitched roofs. In addition to their lowland farms most of the farmers possess *saeters*, or mountain pastures, often one or two days' journey distant, where the cattle are sent to graze during the summer months and where the winter supply of cheese is made. One of the most beautiful of Scandinavian songs is 'The Saeter-Maiden's Sunday' by Ole Bull, Norway's great violinist. This depicts the loneliness and the longing of the solitary maiden who is left to care for the cattle, so far away from her home and companions.

If we should tire of walking, we may vary our trip with boat rides on the numerous lakes, where a regular posting service is maintained, or we may hire a native vehicle at any posting station. These vehicles are light two-wheeled affairs, adapted to the narrow roads and to the short stocky Norwegian horses that are remarkably fast and sure-footed.

If we enjoy mountain climbing we shall find ample opportunity to indulge in this sport. The Kiolen Mountains, which separate Norway from Sweden, extend downward across the country from the north in many peaks and high plateaus. From the great central valley called the Gudbrandsdal, the courageous are invited by the Dovre Mountains to the north or the glittering peaks of the Jotunheim to the south. Skirting the valleys are the wonderful forests of pine and fir, one of the charms of Norway, as well as the source of one-fourth of her national wealth. As we ascend to the higher reaches the evergreens are replaced in turn by birches, dwarf willows, and reindeer moss, and finally we reach the vast silent regions of perpetual snow and ice. Norway has the most gigantic glaciers in all Europe; one of them covers 580 square miles, is 1,400 to 1,600 feet thick, and thrusts scores of branches, like giant arms, into the neighboring valleys and in some cases even to the sea.

But of all the wonders and the charms of Norway, none can compare with the majesty and the sublimity of her fiords, those long arms of the sea extending far inland, sometimes more than a hundred miles—twisting and turning among the mighty precipitous cliffs of the towering mountains. Tiny villages like toy models cluster at the water's edge; *saeters* with their little patch of green perch far up the mountain in almost inaccessible nooks; hundreds of waterfalls leap from the cliffs; and above all the hoary head of the glacier mirrors itself in the still waters of the fiord thousands of feet below.

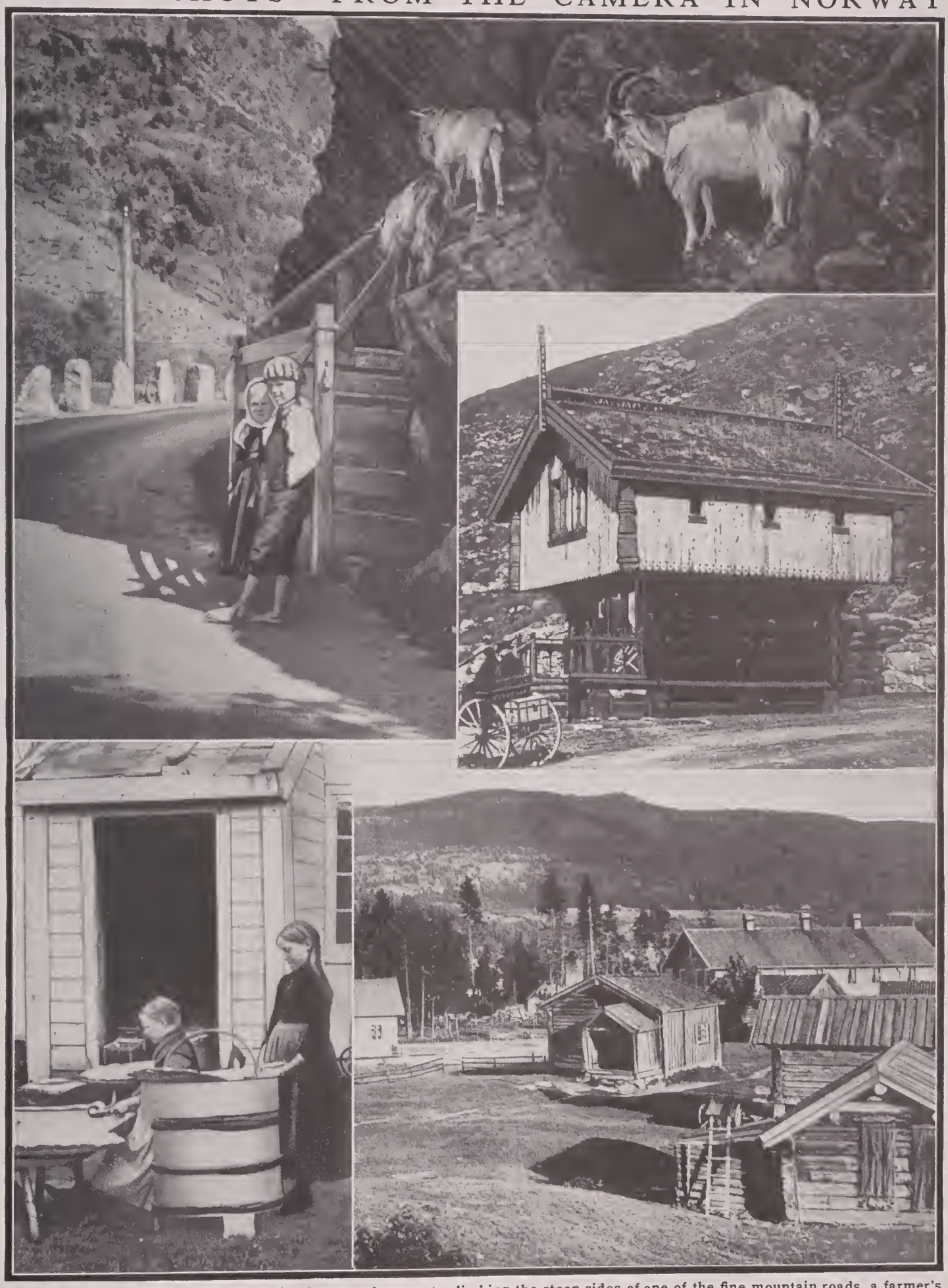
HUMAN "ICE-BOATS" IN NORWAY

This picture shows you how the Norwegians use sails in skating. A race is about to start between these two "skippers." Great skill is required to handle the sails in these races, and under a stiff breeze the skaters frequently attain tremendous speed.

If we should take a summer cruise we would find the countless splendid harbors filled with ships. Doubtless we should visit Stavanger at the head of the lovely Bukken fiord, quaint old Bergen, the second largest city in Norway, known as the birthplace of Ole Bull, and as one of the chief trading stations of the old Hanseatic League; and Trondhjem, the third city of Norway, the ancient spiritual and intellectual center of the north, famous for its magnificent Gothic cathedral, the grandest church in all Scandinavia, where the kings of Norway are crowned.

One hundred miles north of the Arctic Circle, we should reach the wonderful Lofoten or Lofoden Islands lifting their steep jagged snow-capped peaks 4,000 feet above the sea, their lower levels enlivened by millions of eider ducks, whose down is so valuable. Between two of these the rushing tide pent up by the island barrier forms the famous Maelstrom whirlpool. These five islands are the center for the Norwegian cod fisheries. During the first months of the year nearly 100,000 hardy Norsemen from

"STRAY SHOTS" FROM THE CAMERA IN NORWAY



These snapshots, taken by a traveler in Norway, show goats climbing the steep sides of one of the fine mountain roads, a farmer's high-perched storehouse, a group of farm buildings in the pine-clad hills, and peasants making bread. The countryside of Norway has a clean orderly appearance which reflects the careful industry of the people.

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WHERE THE FINGERS OF THE SEA GRIP THE LAND

Here is one of those majestic fiords of Norway, which stretch far inland, always beckoning the people of these rugged hills out to the sea. We may imagine the ancestors of the ancient Northmen trying out their first small boats in these sheltered inlets, and gradually gaining confidence, until they yielded to the call of the open ocean. From that day on, the deep seas have laid their grip upon the men of this Northland, drawing them as sailors to the four corners of the world.

different parts of the coast answer the call of the sea, as did the Vikings of old, and congregate here to take part in this mighty industry. Hundreds yearly lose their lives in this dangerous work.

Near by is Narvik, the terminus of a railroad which cuts across the Scandinavian peninsula from the Swedish port of Lulea on the Gulf of Bothnia, and one of the two most northerly railway stations in the world. Narvik is a busy little place, for it exports annually millions of tons of iron ore, brought from the mines of northern Sweden.

Two hundred and fifty miles north of the Arctic Circle, where sunset and sunrise meet, is Tromso, a city of 10,000 inhabitants, a busy trading post for fur and fish. During the long winter night, from the middle of November to the end of January, the city is lighted by electricity—as are all the buoys and lighthouses along Norway's coast. A sign of the desire of the people of these remote northern regions for culture and learning is the fact that this little city has a college and a museum of natural history.

Finally we reach Hammerfest (2,700 inhabitants, founded in 1787) the northernmost town in the world, visited by tourists from all nations who come to view the splendors of the midnight sun. For in Hammerfest the sun does not set from the middle of May to the end of July, and the long summer day is a busy time for this little port. Great warehouses and hundreds of ships festooned with drying fish line the harbor; the odor of cod-liver oil, the most valuable commodity, pervades the air; whaling expeditions bring in their haul, while Russians and Finns, English, Germans, Swedes, and Lapps, fill the quays with a picturesque throng, chattering in many tongues. Snow lies on the mountains round about, but the grass is green on the slopes and wild flowers bloom in every sheltered nook, for though Hammerfest is 300 miles north of the Arctic Circle its average winter temperature is warmer than that of New York.

Fifty miles north of Hammerfest the coast of Norway and of Europe reaches its farthest point north in the gray barren cliffs of the North Cape; and Spitzbergen, that large valuable group of islands placed under the sovereignty of Norway by the Peace Conference in 1919, lies far north in the Arctic Ocean, a two days' journey distant. This archipelago of five large islands and many small islands has recently become of considerable importance because of the immense coal deposits, which are now being worked by British, Norwegian, and Swedish companies. Other mineral resources, still undeveloped, include iron, copper, and zinc.

Although Norway has little land under cultivation, the farmers get the best possible results out of their small tracts. Oats is the chief grain produced, but none of the cereals are raised in sufficient quantities to supply the needs of the country. Rye may be called the Norwegian's "staff of life," this and barley being the chief bread cereals. Wheat, being less hardy than the other grains, is produced in smaller quantities, and only in the southern parts of the country. Potatoes grow easily in almost all of the inhabited districts, and are one of the chief foods of the people. Cattle and sheep are kept in large numbers; and coöperative dairies have been established, and quantities of butter and cheese are made for export as well as for domestic use. The nomadic Lapps in the far north keep herds of reindeer, which supply them with meat, milk, and hides, and which are also employed as draft animals (*see* Lapland).

The upper picture on this page shows Bergen, Norway's greatest commercial port. At the bottom we see Trondhjem, a seaport on the west coast and the ancient capital. In the middle to the right, is the finest church building in the kingdom, the Cathedral of Trondhjem. On the left is the statue of Christian IV in Christiania.

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CURING COD FISH AT HAMMERFEST

Although Hammerfest is the northernmost town of Europe, situated on Kvalo or Whale Island, only 60 miles from the North Cape, it is still warm enough there the year around to carry on the work of the fisheries, and in summer the heat sometimes becomes oppressive. Quite a bit of work can be done in a day there, for the sun does not set from the middle of May to the end of July.

The forests and fisheries are Norway's chief natural sources of wealth. Fishing is the oldest of Norwegian industries, and still remains one of the most important, the product sometimes amounting to more than $45,000,000 in a single year. Norwegian cod, either salted or dried in the form of "stock-fish," and cod liver oil are shipped to the various European countries and to America. Herring, mackerel, salmon, and other kinds of fish are also abundant. The heads and other waste parts of the fish are used for fertilizer. Whales are hunted in the Arctic Seas, and whale oil is exported in considerable quantities. More than 20 per cent of the total area of the country is timber land, and about three-fourths of this is pine. Lumber, wood pulp, and other forest products are among the most important exports.

The mining industry is relatively unimportant. Copper, nickel, and silver are found, and considerable quantities of iron; but coal is entirely lacking on the mainland. In spite of the lack of coal, however, Norway has been able to develop manufactures to a considerable extent, owing to its splendid water-power resources. Chemicals, machinery, woodenware, wood pulp, and paper are leading products.

The Norwegians are among the busiest sea-carriers in the world, with a merchant marine greater than that of many a far larger nation. Steamers are the most important means of communication between Norwegian ports; although railways also are well developed. Telegraph and telephones are found in the remotest places and the mail service is prompt and adequate. Education is compulsory and there are excellent schools and more than 1,000 state-endowed libraries. The Royal Frederick University at Christiania is the chief educational institution.

The government of Norway is a constitutional monarchy, but to all intents and purposes it is as free as a republic. The king exercises his authority through a council of state composed of a minister of state and at least seven councilors, appointed by the king. The Parliament (called Storthing) is divided after election into two houses. Since 1913 women have enjoyed the franchise on an equal footing with the men. Lutheranism is the state church, to which the king must belong.

From the fiords of Norway in the early Middle Ages set forth some of the most famous of the Vikings whose raids long troubled Europe (*see* Northmen). The land was united into a single kingdom in the 10th century and Christianized in the 11th. In 1397 it was united with Denmark and Sweden in the Union of Kalmar. Sweden seceded from this union 125 years later, but for more than 400 years Norway continued as a dependency of Denmark. At the close of the Napoleonic Wars, in 1815, it was torn from Denmark and handed over to the Swedish king to recompense him for the loss of Finland to Russia; but Norway retained its separate parliament, government, and laws. In 1905 long-standing disputes led the Norwegian Storthing (Parliament) to declare this union dissolved. The Swedish king reluctantly agreed to this, and the Norwegians chose Prince Charles of Denmark as their king. He was crowned in June 1906 as King Haakon VII.

NOUN. A noun is a word that *names*. It may name anything of which anybody may think or speak—as *school, America, kindness, justice, children*. If it is the name of one particular person or object or place, it is called a proper noun. In this sense "proper" means "belonging exclusively to." Your name, *Frank* or *Mary*, is a proper noun, because it belongs to you and distinguishes you from other persons. *Fido, Chicago, America, Saturday, The Mauretania, Paradise Lost*, are proper nouns. Some proper nouns also denote groups of persons, or a member of a group,—as Americans, Frenchmen, Democrats, Baptists. Any noun that is not a special individual name is a "common" noun—as *kindness, cloth, city, book*, etc. Such nouns are called "common" because they belong to more than one person or thing. A special kind of common noun is the "collective" noun, which stands for a group of things or persons—as *class, grove, flock, jury*.

Most nouns in English have two forms, according to whether they mean one object or more than one. The form which denotes one is called the singular number; that form which denotes more than one is called the plural number—as *bird, birds, woman, women*. The plural is generally formed by adding *s* to the singular. Sometimes the *s* plural changes the spelling of the singular—as *city, cities; self, selves*. When adding *s*, nouns ending in *y* after a consonant change the *y* to *ie*; and several nouns ending in *f* or *fe* change the *f* to *v*. Some nouns in *o* add *es*, others add *s* only—as *cargo, cargoes; piano, pianos*. Nouns that end in a sound difficult to pronounce with a final *s* add *es*—as *church, churches*. A few nouns form their plurals by adding *en* or by changing the internal vowel as—*child, children; tooth, teeth*. This was the common way of forming plurals in Old English, or Anglo-Saxon. There are also some foreign plurals in common use—as *stratum, strata; crisis, crises*. A few nouns make no change for the plural as—*deer*.

How Nouns Become Possessive

Many nouns, especially those denoting persons or animals, have another form called the possessive case, because it is chiefly used to denote possession, like the genitive case in Latin. Singular nouns, and all plurals not ending in *s*, add the apostrophe and *s* to form the possessive—as *lady's, children's, Burns's*. Plurals ending in *s* add the apostrophe only—as *ladies', boys'*. In ordinary use, most names of things are not used in the possessive; instead of *the book's cover, the chair's back*, the usual form is *the cover of the book, the back of the chair*. But nouns denoting time are often found in the possessive—as *a day's work, a night's lodging, a seven days' journey*.

Besides the possessive case, nouns, like pronouns, have two other cases, according to the construction in which they are used. Nouns do not change their form to distinguish these cases, though most pronouns do. Nouns and pronouns used as the subject substantive of a verb are said to be in the nominative ("naming") case. Nouns and pronouns used as the direct or indirect objects of verbs (*see* Verbs), as the objects of prepositions, and as the subjects of infinitives are said to be in the objective case. A noun or pronoun in apposition with another (that is, used to modify or explain the meaning of another noun or pronoun meaning the same person or thing—as "Caesar, the *conqueror*") is put in the same case as the word it modifies.

To give in order the various forms which a noun or pronoun may take to indicate different meanings or uses in the sentence is called "declining" it, or giving its "declension." Thus the declension of *child* is: singular, nominative and objective, *child;* possessive, *child's*. Plural, *children, children's*.

In addition to number and case, nouns, like pronouns, have two other properties: gender and person. (For a discussion of grammatical person, *see* Pronouns.) Nouns, except those in direct address, are always in the third person. By gender in English is meant merely whether the noun denotes male or female, or the absence of sex—as *prince, princess*. Nouns denoting males are masculine; those denoting females, feminine; and those denoting things without sex, neuter. Nouns which refer to both sexes are said to be of common gender—as *people, birds*, etc. Gender is of little importance in English.

The Work that Nouns Can Do

Some of the chief constructions in which nouns may be used are illustrated in the following sentences:

Subject and predicate noun: A *dollar* saved is a *dollar* earned.
Direct object: He saved a *dollar* a week.
Object of a preposition: He kept account of every *dollar* that he spent.
Indirect object: Association gave that *dollar* a peculiar value.
Secondary or complementary object: I will make your wages a *dollar* a day.
Subject of an infinitive: I saw the *dollar* disappear down the crack.
Possessive modifier: Give me a *dollar's* worth of sugar.
Adnominal use (exactly like an adjective): This is a *dollar* bill.
Appositive: His pay—a round silver *dollar*—seemed enormous.
Nominative of address: Oh, *dollar*, why did you slip away!
Nominative of exclamation: A *dollar!* what does that amount to?
Nominative absolute: He turned away, his precious *dollar* clutched tightly in his hand.

NOVA SCOTIA, CANADA. Geographers have aptly called the maritime province of Nova Scotia "the doorstep of the continent," for it lies at the entrance to the St. Lawrence River, the passageway to the interior. It occupies the southeastern peninsula of Canada and the adjoining island of Cape Breton, and is connected with the mainland only by a slender neck of land. The principal city is the great port of Halifax, one of Nova Scotia's 12 splendid harbors. Though one of the smallest provinces of Canada, having an area of only 21,428 square miles—less than that of West Virginia — Nova Scotia supports a large population in the settled districts, having nearly half a million people. The majority

AS IN THE DAYS OF 'EVANGELINE'

You see things haven't changed much in the villages of Nova Scotia since the days of Evangeline, so far as the simplicity of life is concerned. In the picture above, we are looking across the village of Gasperaux, and below is the village of Grand Pré itself.

are of British stock, a large proportion being descendants of the United Empire Loyalists who left the United States during the Revolutionary War. Another considerable group is descended from the original settlers, the French-Canadians or Acadians, many of whom were deported by the English in 1755.

Nova Scotia is a region of extensive sea-line, of bold rugged shores, and noble highlands. Since the days when it was first settled by the French and called Acadia, fishing has been one of the principal industries.

Considerable stretches of the "forest primeval" still stand and furnish another source of wealth. In the more progressive sawmills improved machinery has been installed, and great quantities of lumber are shipped each year from Halifax. In the northern part of the peninsula and in Cape Breton Island are rich coal mines, which produce about half of Canada's coal. In the southern part are small gold mines and rich deposits of iron ore.

These industries of fishing, lumbering, and mining are largely in the hands of the British, for the Acadians are farmers, as they were in the days of Longfellow's 'Evangeline', and the "shores of the Basin of Minas" and the "little village of Grand Pré" present much the same appearance to-day as when—

. . . . vast meadows stretched to the eastward,
Giving the village its name, and pasture to flocks without number.
West and south there were fields of flax, and orchards, and cornfields,
Spreading afar and unfenced o'er the plain; and away to the northward
Blomidon rose, and the forest old, and aloft on the mountains
Sea-fogs pitched their tents, and mists from the mighty Atlantic
Looked on the happy valley, but ne'er from their station descended.

When the peninsula passed from France to England, in 1713, the name Acadia was dropped and that of Nova Scotia ("New Scotland") became the official name of the colony. Some of those who had been driven from their homes found their way back in later years; and from these are descended the Acadians of today. (*See* Acadia.)

Nova Scotia is a favorite summer resort with the people of the eastern United States because of its delightfully mild summer climate and the picturesqueness of its coasts, meadows, and orchards. The marshy land which spreads inland along the rivers flowing into the Bay of Fundy is amazingly fertile. Nearly all of it has been diked to protect it from the high Fundy tides. Much of the beautiful Annapolis and Cornwallis valleys are covered with apple orchards, and large shipments of apples are sent in cold storage to England.

Almost from the time of the founding of Port Royal (now Annapolis) by the French in 1605, Nova Scotia was a focal point in the struggle between the French and the British for the New World. Fighting was almost continuous until the final blow to French aspirations was delivered in 1759 by the capture of Quebec (*see* French and Indian War). The previous year saw the capture of the "Dunkirk of the North" —the famous fortress of Louisburg, which the French had built on the Atlantic coast of Cape Breton Island at a cost of $10,000,000 to be the keystone of their naval power in America. Although the peninsula was won by the British in 1713, the island was not ceded until the peace of 1763. In 1867 Nova Scotia became part of the Dominion of Canada. (*See* Cape Breton Island; Halifax; Tupper, Sir Charles.)

The STORY-TELLER *and* HIS MAGIC CARPET

WHEN the average reader speaks of "a good book," we can be almost certain that he has in mind a novel. The novel is only one of many forms of literature, and one of the youngest of them all, yet it has outstripped all the others in popularity. More novels are written and read today than all the poems, dramas, and essays put together. No other kind of writing makes so strong an appeal to the great mass of people, or has so tremendous a power for good and evil. The accompanying article tells you how this youngest and most popular of literary forms came to be born, and sketches its development in the hands of the great novelists down to the present day.

NOVEL. Everyone likes stories. Long ago when there were few books and only priests and clergymen could read, stories reached the mass of the people by word of mouth. But when printing was invented and learning was made more common, there were thousands of readers to be satisfied. Drama still answered the desire for action, but after all there were relatively few people within easy reach of theaters, and relatively few human experiences that could be put on the stage. It was to supply the craving of the average reader for a fuller and more complete view of life that the novel came into being. And this is the secret of the novel's power; it gives contact with life; it puts new meaning into everyday affairs, and it broadens our horizon. People who read the best novels have a magic carpet that takes them where they will—to visit distant lands and ages, and to mingle with all sorts and conditions of men. Many of the characters in fiction are more real to us than those in history; we feel as well acquainted with them as with the people we meet in real life and often understand them better.

The Medieval Story-Tellers

Nothing exactly like our novel of today was known in ancient times, though the Greeks and Romans had their prose tales and romances, such as the 'Golden Ass' of Apuleius, which contains the beautiful story of Cupid and Psyche. The immediate ancestor of the modern novelist was the minstrel of the Middle Ages who traveled from place to place telling or singing his tales. Romances long drawn out and full of high adventure were popular with the upper classes, because they found in them an idealized picture of their own lives (*see* Romance). The lower classes, who got the ragged end of life under the feudal system, liked tales that poked fun at the valiant knights and pious churchmen. They liked stories of rogues and rascals seeking adventure or of life as they themselves lived it. So alongside of the metrical romances we find the *fabliaux*, telling lightly in verse stories of ordinary life; and similar stories in prose, called by the Italians *novelle*, meaning "new stories," from which the English term "novel" is derived. A little later there appeared in Spain another type of story dealing with low life, the "picaresque" novel, which told at considerable length the adventures of a *picaro*, or rogue, as the romance sang the noble deeds of the knight errant. Somewhat akin to these picaresque novels and yet different from anything that had appeared before was Cervantes' famous burlesque romance 'Don Quixote'. (*See* Cervantes.)

The two classes of stories—the romance on the one hand, and the *fabliau*, *novella*, and picaresque novel on the other—grew up side by side and were the forerunners of the two main types of modern prose fiction the "romance" and the "novel." The term novel is now usually applied to a narrative of considerable length with a more or less intricate plot, which pictures life as it is, dealing with characters and events that have been or might be real. The romance gives greater freedom to the imagination, deals with more unusual aspects of life, and is usually more concerned with telling an exciting story than in the study of character. Thus Scott's 'Ivanhoe' is a romance, while George Eliot's 'Mill on the Floss' is a novel. In common usage, however, any work of prose fiction is called a novel, and we speak of "realistic" and "romantic" novels.

Many prose romances were written in England in the Elizabethan Period, the age of Shakespeare, though they are quite overshadowed by the great dramas of that time. Lyly's 'Euphues' is remarkable for its elaborate artificial style, its involved and nicely balanced phrases. Sir Philip Sidney's 'Arcadia' is a long-drawn-out pastoral romance interrupted with passages of verse. Both of these romances were written for the upper classes and did not appeal to the ordinary man.

Bunyan's 'Pilgrim's Progress', the great Puritan prose epic, did teach the masses and still holds its popularity because of its truth to human nature. Although it is an allegory, it is, strange to say, in some ways very much like the old picaresque or rogue novel; only here the adventures of the hero are symbolic and spiritual rather than worldly.

The same men and women and children who liked 'Pilgrim's Progress' were delighted with Defoe's 'Robinson Crusoe'. Although the adventures of Crusoe on the lonely island are almost entirely pure imagination, Defoe's marvelous power of description makes them seem absolutely true to fact.

The Birth of the Modern English Novel

'Robinson Crusoe' is often called the first English novel. Yet it is hardly a novel in the modern sense. It is a tale of adventure in a far-away place rather than of life as we know it; it lacks plot, being a series of happenings loosely strung together, and there is no character analysis. The novel of ordinary domestic life and manners owes its beginning, in the middle of the 18th century, to an accident. Samuel Richardson, a London printer, was invited by a publisher to prepare a volume of letters which might serve as models to country readers. It occurred to Richard-

son that the letters would be more instructive and interesting if they were made to tell a connected love story and point a moral. The result was 'Pamela, or Virtue Rewarded'. So great was its vogue, especially among women, that it was followed by another novel 'Clarissa; or the History of a Young Lady', usually considered Richardson's masterpiece, and then by one with an ideal man as its hero, 'Sir Charles Grandison'. Richardson's characters in letters of incredible length devote pages and pages to discussions of what they say, think, and feel. The ladies, who are virtuous and saintly beyond belief, are continually weeping or fainting, the villains are very black, and the heroes models of copy-book perfection. No writer before had so painstakingly dissected the hearts of his heroines and analyzed their feelings. It was this that held the attention of his readers, but to one man at least Richardson's sentimentality and his pretentious moralizing were distasteful. Henry Fielding was moved to burlesque 'Pamela' much as Cervantes had burlesqued the old romances. But in writing 'Joseph Andrews' he became so interested in his characters that the result was a realistic novel rather than a burlesque. Here, and most of all in his masterpiece 'Tom Jones', we feel that his characters are real flesh and blood creations, neither entirely good nor entirely bad, but decidedly human.

Neither Richardson nor Fielding, nor their contemporaries, Smollett and Sterne, great as they were and important as their work was in the history of the novel, have a wide appeal today. But one novel written just a little later still remains a favorite of young and old. That is Goldsmith's 'Vicar of Wakefield', a delightful story of simple home life. (*See* Goldsmith, Oliver.)

Fashions in Novels

Novels usually follow the fashion of the times in which they are published. When in the early part of the 19th century the movement toward romanticism came to its climax, there was a great interest in the Middle Ages, and the historical novels of Sir Walter Scott were a natural outcome. It is true that there were novels which had pretended to be historical, but it was not until research into former periods had been undertaken in real earnest that the historical novel developed to the full with all its wealth of background and detailed description. The Waverley novels of Sir Walter Scott were copied all over Europe.

But during the same period, far off in a little English village lived a gentlewoman who wasn't interested in depicting the world of history or even the world of her own day. Jane Austen wrote novels which gave a universe in miniature—the life of her own rural England. The sentimentality of Richardson and of the Gothic romancers who filled their books with haunted chambers and mysterious castles aroused her sense of the ridiculous. She wrote about the people that she knew and with sly humor showed character so skilfully that Sir Walter Scott liked to compare her with Shakespeare. 'Pride and Prejudice' and 'Emma' are books which sparkle at the third reading as much as at the first.

The 19th century saw the field of the novel immensely widened, to keep pace with the growing complexity of life. Science, religion, social reforms, labor and capital, war and peace, and many other problems were stirring people's minds. The new era of machinery had brought people into town where they lived miserably under unsanitary conditions (*see* Industrial Revolution). Old laws no longer fitted new customs and a new race of writers grew up to combat them. Charles Kingsley, Mrs. Gaskell, and, above all, Charles Dickens were writers of the humanitarian novel. Perhaps the first two writers felt just as keenly as did Dickens, but they did not possess in so great a degree the humor, pathos, power of description, and realism that made Dickens' work endure. His own story, which with some modifications forms the basis of the narrative in 'David Copperfield', is to most readers the most interesting of his novels.

Thackeray and George Eliot

Dickens was of the people; Thackeray belonged to the upper classes. History was fascinating to him and became the background of some of his best novels, 'Henry Esmond' and 'The Virginians' among others. The book by which most people know him best is 'Vanity Fair' in which he exposes the shams and meanness of the fashionable society he knew so well.

George Eliot (Mary Ann Evans), a woman who wrote a little later, did not show the world as a dramatic spectacle, as did Dickens and Thackeray. She was more interested in the minds and souls of her characters. She knew how to make the struggle in a little girl's mind as interesting as a battle. When one remembers that Maggie in 'The Mill on the Floss' is really George Eliot herself, it is easier to see why the author has such an uncanny insight.

These writers are representative of the main movements in the novel during the 19th century: Scott of the historic romance; Jane Austen of the novel of manners; Dickens of the humanitarian novel; Thackeray of the picture of society as a whole treated from without; George Eliot of the novel of the mind or psychological novel.

As we come down to recent and present-day English writers, we find Stevenson the disciple of Scott and the great French romancer Dumas in his love of romance and adventure; George Meredith, carrying the novel of the mind and manners to such an extreme of complexity that some people can't understand him at all, and Thomas Hardy, writing realistic stories of the English countryside which have all the elements of inexorable fate in a Greek tragedy.

Still later came Barrie, Bennett, Wells, Galsworthy, Conrad, and a host of others. Wells, who began with scientific romances somewhat in the style of the Frenchman Jules Verne, has become mainly

concerned, as in 'Joan and Peter', with social reform and education. Arnold Bennett, who writes books that resemble the old Flemish painters in their careful detail and their faithful description of ordinary experiences, has learned much from the great French masters of fiction. His best work centers about the "Five Towns" of the pottery industry of England. Barrie has a romantic whimsical style all his own. Galsworthy draws somber pictures of the injustices of modern society. Joseph Conrad, born in Poland, but living the greater part of his life as an officer in the English merchant marine, has written of the sea and of strange lands in novels that are masterpieces of style and of insight into character. Among the host of other recent English novelists who deserve mention are George Moore, follower of the French school of realism; Eden Phillpots, who writes novels of Devonshire somewhat in the manner of Hardy; Maurice Hewlett, writer of artistic romances; William De Morgan, whose long and rambling but delightfully human novels have had many enthusiastic readers; W. J. Locke, loved for his humor and understanding and his sunny philosophy; and W. L. George, who is especially concerned with the study of women and their problems.

Fiction in America

The novel in America showed much the same tendencies as in England. James Fenimore Cooper in the first half of the 19th century "laid the foundations of American romance" and won the title of "the American Scott." Hawthorne probed deep into the recesses of the human mind and soul, but he set his stories in a twilight atmosphere instead of in the broad light of common day, and hence he was justified in calling them romances rather than novels. In the later 19th century and reaching well into the still more complex 20th century, we find Henry James, writer of psychological novels, still more subtle and appealing to a still smaller circle of readers than those of Meredith, and William Dean Howells, distinctly a realist of everyday American life. There has been a host of novelists since, and many of them have produced work of high quality, but it is still a question whether any of them may be called great (*see* American Literature).

On the whole the novel in America loses in comparison with that of England, but there is one field in which America has surpassed England, and that is in the short story. The short story is not merely a story that happens to be short, but is a distinct type of fiction, marked, as Brander Matthews tells us, "by its unity, its totality, its concentration upon a single effect or a single sequence of effects." In the hands of Poe and Hawthorne, and later of Bret Harte and O. Henry and others, the short story has reached a high degree of artistic development.

We can only glance at the novel in other lands. It is to Italy, in a sense, that we owe the novel form, but the Italian "novella" was really more like our short story than our novel. Alessandro Manzoni in the 19th century is the first modern Italian novelist of international importance, and Matilde Serao and Gabriele D'Annunzio (the latter better known as a poet and dramatist) are his greatest successors.

In Spain there has been no name as great as that of Cervantes, but since the middle of the 19th century the novel has been a very popular form. The best-known names are Fernan Caballero, Pedro Antonio de Alarcón, Pereda, Galdós, and Blasco Ibanez, the last probably more widely read in England and America than in his own country.

In the Scandinavian countries Björnson, the greatest novelist of Norway, was followed by Selma Lagerlöf, who wove the folklore of Sweden into beautiful romances, and by Johan Bojer and Knut Hamsun, who have produced powerful realistic works.

Henryk Sienkiewicz, author of 'With Fire and Sword', and other historical romances dealing with the struggle of the Poles, is the chief representative of Poland. He is perhaps best known in other countries for his 'Quo Vadis', a historical novel of the time of Nero. In Germany in the 18th century Goethe wrote the most famous of sentimental novels, 'The Sorrows of Young Werther' and the great autobiographical novel, 'Wilhelm Meister'. Then came the picturesque humorous stories of Jean Paul Richter, and the romances of Tieck, Fouqué, von Kleist, and many others. Paul Heyse, Gottfried Keller, and Hermann Sudermann are among the most important German novelists of recent times.

In France it was not until the 19th century that the novel became one of the chief forms of imaginative writing. Victor Hugo and Alexandre Dumas were inspired by Scott to enter the realms of history and romance. Flaubert in his famous 'Madame Bovary' combined romanticism and realism. Balzac insisted that fiction must be based on observation and experience, and was largely influential in spreading realism throughout Europe. Zola went farther, attempting not merely to photograph, but to dissect human nature, and dwelling for the most part on its sordid and unhealthy aspects. French idealism was seen again in Romain Rolland's biographical novel 'Jean Christophe', which not only covered in detail the life of one man, but gave a wonderful picture of Europe before the World War.

The Russian Novelists

Perhaps no other country has had so great an influence on recent fiction as has Russia. The powerful novels of Gogol, founder of the modern realistic school in Russia, of Turgenief, one of the greatest prose artists of the 19th century, of Dostoyefsky, with his subtle psychology, and of Tolstoy, great in this as in many other fields, have come as a challenge to the rest of the world. While their influence has led to the emphasis of the darker side of life, they have done much to strengthen and vitalize the novel.

Now that hundreds of novels—good, bad, and indifferent—are published every year, it is important

for the reader to have a touchstone to test their worth. What makes a good novel? There are three essentials in the novel—characters, plot, and setting. A good novel represents lifelike characters talking and acting under interesting circumstances, and through their acts becoming involved in a complication of events which is brought to a satisfactory conclusion. In 'Henry Esmond', which many consider the most perfect novel in the English language, Thackeray shows his mastery in the analysis of character, in the structure of the plot, and in his description of the age in which the scene is laid. But many excellent novelists show no such harmonious development of these three elements. Dickens, for instance, often pays little attention to plot; while with Scott the portrayal of character is subordinate. It is impossible to lay down hard and fast rules, for it is the privilege of a genius to break all rules of art. But one thing we can demand of a novel and that is that it must ring true. Even a romance, which may have strange and unusual characters, must not violate the fundamental truths of human nature. Worst of all is the novel that pretends to picture "real life," and gives a false and distorted picture. It is hard to measure the harm that is done by books of this sort. For the novel has, with the possible exception of the drama, the strongest moral influence of all the forms of literature. This does not mean that the novelist should teach a definite lesson—indeed a too obvious moral purpose spoils a novel; but because he deals so intimately with real life, he cannot get away from questions of morality. For this reason we should be as careful in choosing the novels we read as we are in choosing our friends.

NOVEMBER. In the old Roman calendar November was the ninth month, as its name indicates, but it is now the eleventh owing to the change of the year's beginning from March to January. At the same time the number of days was increased from 29 to 30. It is said that the Roman Senate proposed to rename the month in honor of Tiberius, who succeeded Augustus as emperor; but he declined, saying: "What will you do, Conscript Fathers, if you have *thirteen* Caesars?"

NUMERALS. From the earliest times men have counted on their fingers, and the system of making straight marks or "tallies" as a record of numbers probably grew out of this practice. When the habit arose of "scoring" tallies with cross strokes into groups of five (thus, 卌 卌), each group represented the fingers of one hand. After a time this was found to be too small a unit, and in the end men almost universally adopted the "decimal" system of counting by tens, representing the fingers of both hands. The ancient Babylonians, however, used a "duodecimal" system of counting by twelves, derived from their study of the stars. We still use this duodecimal system in counting eggs, reckoning the hours in a day, inches in a foot, etc. It has the advantage of expressing thirds and quarters more conveniently.

Of all the older systems of number notation, the Roman system is the best known. Indeed, we still use it for certain purposes, such as marking the hours on clock dials, in numbering the volumes and chapters of books, and in inscriptions on buildings. In this system seven letters are used to represent numbers, with the value given below:

I	*V*	*X*	*L*	*C*	*D*	*M*
1	5	10	50	100	500	1,000

The letter *C* is the initial letter of the Latin word *centum*, meaning "hundred" and *M* of *mille*, "a thousand." When a letter of less value is written *before* one of greater value, the numeral represents the *difference* between the two values. Thus IV equals 4; XL equals 40; XC equals 90. When the letter is written *after* one of greater value, the sum of the two is represented. When a bar is placed over a letter its value is multiplied by 1,000. Thus $\overline{V}$ equals 5,000; $\overline{XIV}$ equals 14,000. From the following table giving Arabic equivalents the value of any Roman numeral can be found:

I... 1	XI...11	XXI... 21	D... 500
II... 2	XII...12	XXX... 30	DC... 600
III... 3	XIII...13	XL... 40	DCC... 700
IV... 4	XIV...14	L... 50	DCCC... 800
V... 5	XV...15	LX... 60	CM... 900
VI... 6	XVI...16	LXX... 70	M...1,000
VII... 7	XVII...17	LXXX... 80	MM...2,000
VIII... 8	XVIII...18	XC... 90	$\overline{IV}$...4,000
IX... 9	XIX...19	C...100	$\overline{V}$...5,000
X...10	XX...20	CC...200	$\overline{IX}$. .9,000

Advantages of "Arabic" Numerals

The Roman system has some serious shortcomings, as you will see if you try to add, subtract, multiply, or divide a series of numbers written in this way. For instance, try to find the product of:

XLVIII times MDCCXCIV

If we write the sums in the so-called "Arabic" numerals, the problem becomes much simpler:

48 times 1,794

In part this greater simplicity is due to the fact that each of the digits in the "Arabic" system is a single character (1, 2, 3, and so on, up to 9), instead of being composed, as most of the corresponding Roman numerals are, of several characters or letters (II, III, IV, and so forth). It is also due to the fact that the "Arabic" system is based on an improved principle, that of place value. In the number 555, for example, the 5 at the right stands for 5 units or ones, the middle 5 for 5 tens or fifty, and the one at the left for 5 hundreds. This makes possible a *decimal* system, the place value of the numbers increasing tenfold to the left and decreasing in the same ratio to the right.

The Arabic system of numbers is a convenient one, but before the zero was invented, for several hundred years after the system came into use, men found it difficult to write such a number as 1,030, or 3,042,050. The invention of the zero made possible

the simplified arithmetical processes in use today in place of the older ones which required the "abacus," or counting frame. It gave the world a system of numbers which has proved a great help in advancing both science and trade. The zero is for this reason considered one of the great inventions of the world.

In their earliest form the "Arabic" numerals are not Arabic at all, but come from the Hindus of far-off India. The first trace that we have of them (without the zero, however) is in some rock-cut inscriptions in Central India, which go back almost to 300 B.C. In Europe we find some examples of the nine digits (again without the zero) in manuscripts which date from early in the Middle Ages, probably derived from contact with the Saracens who then ruled Spain. But the real introduction of the "Arabic" system into Europe came with the rise of commerce which followed the crusades. Then for the first time West and East were brought into continual contact, and we may consider the new system of notation as one of the many gains of Europe from the activities of the Italian merchants. The zero was now an established part of the system. The old and cumbersome Roman system was not entirely replaced, however, by the Arabic until the 16th century. (*See* Arithmetic.)

NUREMBERG, BAVARIA. An old South German folk-song tells us that—

> Whoe'er would see the German land
> And know the German heart,
> Needs but to go to Nuremberg,
> The home of German art.

And it is true that in this city of Bavaria we get both the old and the new land. The old city walls and turrets, the great gateways flanked by massive towers, the irregular streets, and quaint gable-faced houses, all carry us back hundreds of years to the time when Nuremberg (German *Nürnberg*) was the gateway through which passed much of the rich goods of the East on their way to northern Germany. The old houses, whose upper stories jut out over the street, seem to be leaning toward each other in a confiding manner, and their picturesque windows and overhanging balconies whisper secrets of long ago.

Over the doorway of one of these houses appears an inscription showing that there Hans Sachs, the great poet and playwright of the 16th century, wrote his comedies and songs at the same time that he made shoes for the citizens of Nuremberg. The quaint little Brattwurstglöcklein, where he met his neighbors, is a lean-to to a church where beer and sausages are still served. Another of the old mansions pointed out now as one of Nuremberg's most treasured relics is that in which Albrecht Dürer the painter lived. It was Dürer and his companion artists of the "Nuremberg school" who made this city "the home of German art," and here we can see many specimens of their work. But most of Dürer's paintings have been sold and one must go to Munich and Berlin to see them. At St. Sebald's Church are the Twelve Apostles, the masterpiece of Peter Vischer, Germany's greatest worker in bronze. And at that of St. Lorenz are to be seen the work of Wohlgemuth, the master of Dürer, and of Adam Krafft, the stone and wood carver. The large art museum houses many other treasures.

THE MARKET PLACE IN NUREMBERG

The Market Place in picturesque old Nuremberg, with the peaked gables of its tall and broad houses turned toward the street, carries us back to the Middle Ages. But not all these houses are old, for most of the citizens of Nuremberg, in building new houses, are careful to imitate the old houses, red tile roofs and all.

High above this ancient section of the city towers the old castle with its underground passages and its "chamber of horrors" in which are medieval instruments of torture, such as the famous "iron virgin"—a great hollow spike-lined female figure, into which the victim was supposed to be thrust, and the spike doors were then closed on him.

For its greatness as a medieval center of commerce, modern Nuremberg has substituted the great factories outside the old city walls, where are made many things, from great locomotives to lead pencils and wonderful dolls and toys. Population, about 340,000.

Nursing. Ministering to the sick and helpless is one of the oldest of arts, but it is only within the past half-century that trained nursing has become a recognized profession. During the Middle Ages, religious organizations cared for the sick, and the Sisters of Mercy are one of many nursing organizations today animated by the same motive. But it was not until the great and noble work of Florence Nightingale (*see* Nightingale, Florence) that the impetus was given to the movement that lifted nursing to importance and dignity as a profession. In 1872 the first class of scientifically trained nurses was graduated in the United States.

There is probably no other occupation for women which presents a wider field than does nursing. While the term originally meant little besides taking care of the sick, it now includes a large number of public and social duties. Public health work, service as school nurse, inspection of housing conditions, the direction of medical gymnastics, are only a few of the many attractive avenues of service that are open to the trained nurse, and the list is constantly growing.

Most general hospitals conduct training schools for nurses, which graduate classes after terms of study of two years or more. Application for entrance is made to the superintendent, and after a physical examination the applicant is received for a term of probation. If, in the few months of this probation, the applicant proves to be physically and mentally able to meet the demands of the profession, she signs an agreement to remain for the rest of the required term. Student nurses receive board, lodging, laundry work, and a small salary sufficient to buy the uniforms and a few simple necessities. Lectures covering anatomy, physiology, and all departments of medicine are given by the staff of house and visiting physicians and surgeons, and the head nurses teach bandaging, dressing of wounds, and other practical details. Those who complete the course and pass the examinations, and whose record is otherwise satisfactory, are graduated.

As a protection both to patients and nurses most states have laws governing the registration of trained nurses, similar to those which control the admission of physicians to practice, and only nurses so registered are entitled to use the letters R. N. ("registered nurse") after their names. (*See* First Aid; Hospitals.)

The best hospitals take pride in the quality of the instruction they give and the care which they take of their students' health, but some so-called hospitals do not scruple to exploit the services of pupil nurses and interns without making them any adequate educational return. A graduate of such a "school" may find she has given three years of hard work for a diploma which does not permit her to become a registered nurse in her own state, and which is an actual barrier to advancement anywhere. Before entering a hospital for training, a girl will do well to make inquiries of the state board of nurse registration and the state nurses' association of the state in which the hospital is situated, and also of one of the national nurses' organizations.

Nuthatches and Creepers. The nuthatch is an expert bird gymnast. He can hop head first down a tree trunk quite as easily as he can hop up it, for he is furnished with sharp claws, well adapted for holding to the rough bark. Unlike the woodpecker, he does not depend on his tail for support.

The characteristic nuthatch has a straight bill, nearly as long as its head. In color these birds are generally plain bluish- or brownish-gray above, and white and buff beneath. They are chiefly an Old World family, for of the 40 species known only four are found in America. In structure and habit the nuthatch occupies a place between the creepers and the titmice. The white-breasted nuthatch of the eastern United States is a typical species. Its cheerful *yank! yank! yank!* is a welcome sound in the quiet winter winds.

TWO FEATHERED GYMNASTS

"The nuthatch is an expert gymnast. He can hop head first down a tree trunk quite as easily as he can hop up it, for he is furnished with sharp claws, well adapted for holding rough bark."

Creepers are found in temperate regions of both the Old and New Worlds. They are dull-plumaged birds, a little smaller than the English sparrow, with long slender bills. They get their name from their habit of creeping up tree trunks where they find the small insects on which they feed. (For illustrations in colors of brown creeper and white-breasted nuthatch *see* Birds.)

Nutmeg and Mace. The fragrant spice we call nutmeg is the seed of the nutmeg tree. From the fruit of this tree is also obtained mace, another popular spice which has an unmistakable and characteristic flavor of its own, quite unlike that of nutmeg. "The nutmegs must be able to smell the sea and the cloves

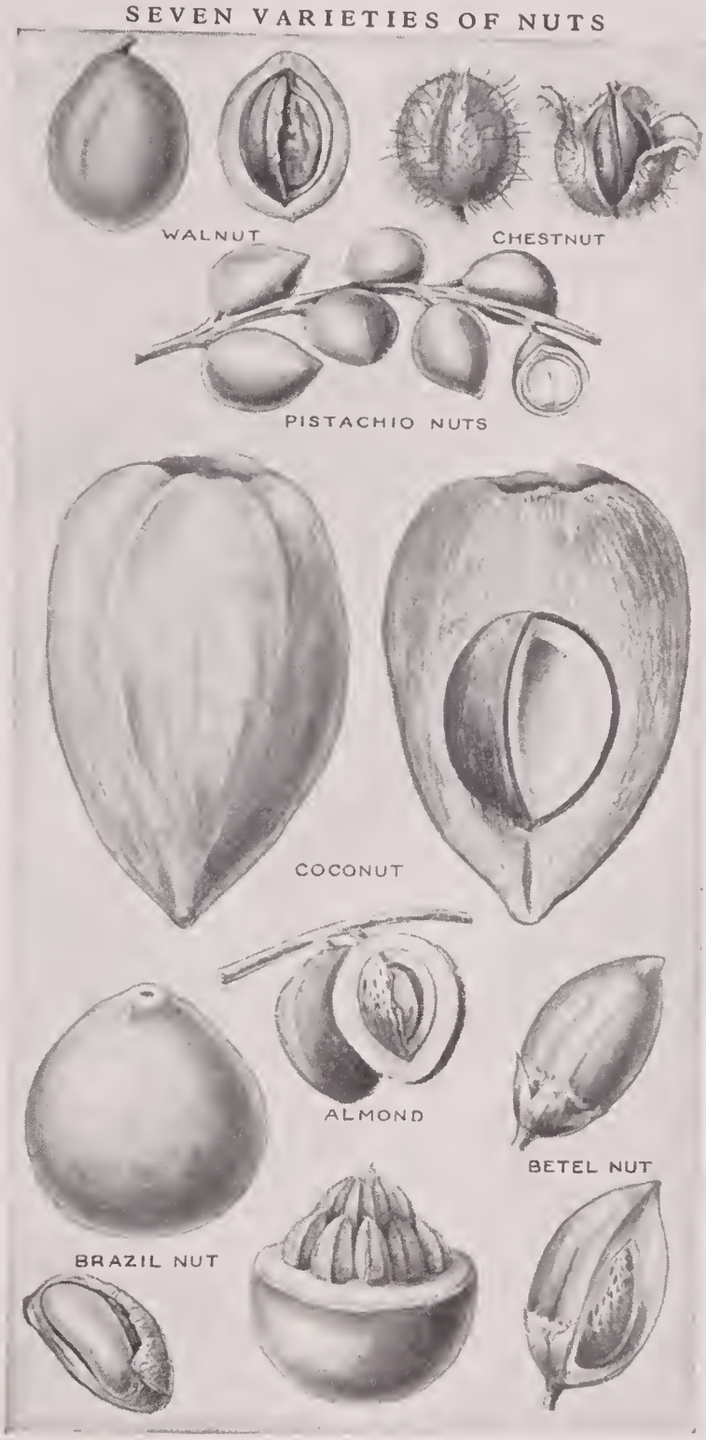
see it" is a common saying, referring to the fact that there have been few successful plantations of nutmegs at any distance inland. Indeed, most of them are on tropical islands, chiefly the Banda Islands of the Dutch East Indies, which are almost covered with nutmeg plantations.

The nutmeg tree blooms and bears fruit continuously. When the principal crop is ripening, a nutmeg plantation is a gorgeous spectacle. The fruit, which is pale orange in color and about the size and shape of a pear, splits open into two halves, revealing the crimson network of fiber—the mace—which covers the seed or "nutmeg." As the breeze stirs the glossy dark leaves they seem lined with silver. The blended fragrance of fruit and leaves is indescribably sweet.

When the fruit is collected, the fleshy husk is removed, and the mace is carefully stripped off, dried, and prepared as a highly flavored spice similar to the nutmeg. Then the seed shell is broken off, revealing the hard kernel, the nutmeg of trade. The latter is elliptical in shape, about an inch long, and irregularly ridged. The fleshy part of the fruit preserved in syrup is a favorite sweetmeat in the Dutch East Indies.

The scientific name of the most common nutmeg tree is *Myristica moschata*, though there are about 80 species of these trees and shrubs. The species named is a handsome bushy evergreen, with straight and lofty undivided trunk about 25 feet high, the branches extending nearly to the base of the tree. The flowers are small and yellow, and have a fragrance resembling greatly that of the lily of the valley.

SEVEN VARIETIES OF NUTS



These pictures show us how these nuts look in their natural state, and how they look when cut open. Notice that several Brazil Nuts are packed together inside the big outer shell.

Nuts. The list of those useful hard-shelled fruits we know as nuts is a long one, and they differ widely in size and flavor. Their use as a food and as an addition to various confections is increasing, and in the markets a great array is offered for sale, from the tiny pinyon nut, the seed of a pine of the Pacific coast, to the coconut, which ripens in the lofty crown of the coconut palm in the tropics.

By far the larger part of the favorite nuts in America are the fruits of the great handsome trees belonging to the walnut family—the black walnut with its wrinkly hard shell enclosed in a round smooth husk on the end of the twig looking like a cluster of little osage oranges; the rich strong-flavored butternut, which, alas, so soon becomes rancid; the English walnut, which gets its name from the fact that the first importations came to Boston and New York markets from England. "Persian" walnuts is a more accurate name, for they grew first of all on the hillsides of Persia and Asia Minor and long, long ago oriental princes sent them as presents to the rulers of lands that did not grow them. Now walnuts equaling in size and flavor those of the south of Europe are raised in California. The pecans and hickories are also members of the walnut family, and are valuable commercially.

The chestnut, also, has long been prized. In some sections of southern Europe are famous old chestnut trees supposed to be 500 or more years old. These sturdy trees are heavily burdened in October with the nuts, which fall out of their prickly burrs, much as our own chestnuts do in the late fall. These chestnuts, however, are bigger than ours and not so sweet and well flavored. The little chinquapins are the fruit of a dwarf species of chestnut growing in the Middle States, South, and West.

One of the hardest nuts to crack but most delicious to eat is the Brazil nut or "nigger-toe," which is grown in Brazil and other parts of tropical South America and in French Guiana. These three-sided

nuts grow in clusters of 20 or more, tightly packed inside a great hard round shell, the color of a coconut and as big as a man's head. When the nut is ripe it falls to the ground, and as the trees are 100 feet or more high, it is not surprising that the natives will not go near one of the trees in a heavy wind.

Pistachio nuts, oily, and of an agreeable flavor, their pale green kernels enclosed in a thin two-parted shell, are seeds of a tree native to Asia Minor.

From the West Indies and tropical America come the cashew nuts, those queer kidney-shaped nuts which are becoming popular in the United States roasted in oil and salted like almonds.

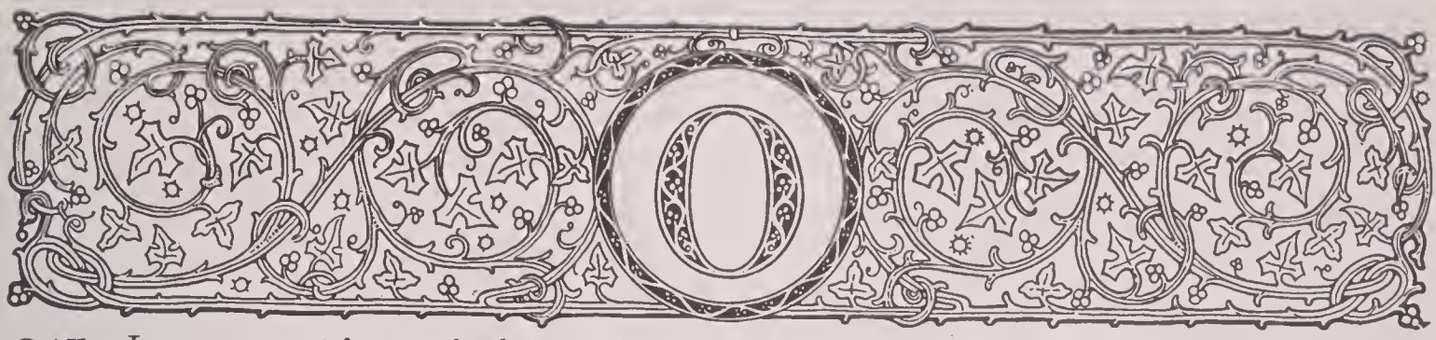
The almond is a great favorite (*see* Almond), but the coconut is the most valuable of all nuts. At first it grew only along the East Indies coast and the South Sea Islands, but it can be found now in the tropics of all the continents, and is the chief food of the inhabitants of many tropical lands. This wide distribution came about unaided by man. Coconuts can float and are not injured by sea water, so they drift to distant shores (*see* Coconut Palm).

If a vote were taken among American small boys and girls and their elders, the peanut would be awarded the prize for popularity, and rightly too. Even though it is humble in its origin as an underground seed-pod and humble in its associations, its cultivation and sale have made for it a preferred place in the favor of the great public (*see* Peanut).

The food value of nuts is high. They usually contain much oil and some protein. Eaten with starchy, bulky foods and green vegetables, they are wholesome and easily digested, but munched between meals or eaten at the end of a heavy dinner, they put a severe tax on stomachs already supplied with sufficient food.

Many nuts are valuable for other purposes. Several are useful in medicine, as the poisonous seeds of *Strychnos nux vomica* of southern Asia and the East Indies. Some are the sources of oil, among them the coconut, the sweet and bitter almond, the ben-nut of the East Indies, the candle-nut of the South Sea Islands, the dika-nut of West Africa, and the pine nuts of Europe and America. The bladder-nut of Central Europe is used for beads in necklaces; the boomah-nut of Africa is used in tanning; the cumara nut of Brazil for perfume, the gru-gru nut of South America for beads, and the soap nut of the West Indies for washing and ointments. Ravensara nuts of the West Indies are used as a spice, and the tagua or "vegetable ivory" nuts for coat buttons.

Nymphs. To the imaginative Greeks of ancient times all the seas, streams, fountains, caves, hills, and woods seemed peopled with divinities. The fair young goddesses who presided over various parts of the world of Nature were called nymphs. In the limpid springs, fountains, brooks, rivers, and lakes dwelt the Naiads, beautiful water nymphs. The Oceanides (daughters of Oceanus) were nymphs of the great sea which was believed to surround the whole earth. The Nereids were the nymphs of the Mediterranean; clad in their flowing green robes, they might be seen dancing over the waves. Of their number was Thetis, the mother of Achilles. The Oreads, or mountain nymphs, represented as tall graceful maidens, were the constant companions of Artemis, the huntress goddess. The unfortunate Echo was an Oread. The Napaeads, the shyest of the nymphs, dwelt in the valleys. Every tree was believed to have its own nymph, called a Dryad or Hamadryad, who was born when the tree began to grow, dwelt in it, suffered if it was mutilated, and sickened and died when the tree withered and perished. Although the Dryads were subject to death, like mortals, they remained young while they lived.



OAK. Long ago great forests of oak covered whole sections of England and central Europe, and although they have been gradually cleared with the progress of civilization, the hardy oak still remains among the most important of trees in France, Germany, and southern Russia, supplying quantities of lumber which is universally useful. In the American forests we encounter a bewildering variety of noble oaks which vary widely in size, color of bark, and leaf forms. There are more than 200 species of the oak distributed over the temperate parts of North America, Europe, Asia, and northern Africa, a few species extending into the tropical Andes, the Himalayas, the Philippine Islands, and Borneo.

THE BRAVE OLD OAK

This stately monarch of the greenwood is one of the most important trees in all temperate lands.

All oaks bear acorns, a fruit peculiar to these trees. The Indians of New England and farther south ate the acorns of several species of white oak. Pacific Coast Indians still eat the sweet acorns of the California white oak, baking, shelling, and grinding them into a coarse meal from which they make bread. Hogs feed upon acorns, and squirrels and some birds store them away for winter food.

About 50 species of the genus oak are native to America, including some of the finest forest trees of the United States. Among the best known species is the white oak, a stately graceful tree, reaching a height of 70 to 100 feet. It is covered with large deeply lobed leaves, light green above and whitish beneath. In autumn the foliage turns deep violet and clings to the tree throughout the winter, falling when the new leaves appear. Such clinging leaves are characteristic of many of the oaks. The trunk of the white oak, which often reaches a diameter of three to four feet, is covered with whitish furrowed bark, which gives the tree its name. Its large egg-shaped acorns, set in cups, grow singly or in pairs on short stalks. The tree attains its greatest perfection in the forest, but on account of its spreading top it is highly valued also as a shade tree.

The bur or pin oak is another well known and valuable American species. This is a hardy beautiful tree, often towering to a height of 150 feet, though the average height is about 75 feet. Its deep green leaves are very large, sometimes measuring from 10 inches to a foot in length, deeply lobed at the lower part and rounded at the apex. It bears exceptionally large acorns, set in rough cups with a noticeable fringe about the edge. The bark is brownish-gray and furrowed. The bur oak is comparatively rare east of the Alleghenies, but it is found from Pennsylvania to Montana and south to Texas.

The red oak is perhaps the most beautiful of the American species, presenting a picturesque appearance in all seasons. The round solid top is covered with large sharply lobed leaves, which are pink and furry in the spring, green in summer, and deep purple-red in autumn. The bark is dark brown, thick, and furrowed. The red oak also bears large acorns set in shallow cups.

The chestnut oak (also called the chinquapin), although possessing the main characteristics of the oak family, is conspicuous on account of its chestnut-like leaves; these are serrated or "saw-toothed" instead of deeply lobed. The tree is tall and stately, with stout trunk and limbs. (*See* Chinquapin.)

The live oak is a beautiful Southern form of smaller size but sometimes rising to a height of 60 feet. The branches are spreading and graceful, and are covered with small glossy evergreen foliage. It is rarely found more than 50 or 60 miles inland from the Gulf of Mexico.

The well known British oak is the largest and most valuable of all the oak trees and is celebrated in myth and history. This tree is a veritable giant, with

sturdy limbs and enormous girth. The peculiar zigzag growth of the limbs in older trees gives them a twisted appearance which gives rise to the phrase, "the gnarled British oak," and adds to the picturesque appearance. This kingly tree lives to a great age, and some fine specimens which are still standing in England date back to the Anglo-Saxon period. This species is liberally scattered over Europe. It is not a native to America, but is gradually being introduced and may be found along the streets, in the parks, and in planted forests.

"TALL OAKS FROM LITTLE ACORNS GROW"

This picture shows the furrowed bark of the White Oak and the serrated leaf, with its many fingers, characteristic of all oaks. The acorns, singly or in pairs, grow from the stems. They are held fast in their cuplike husks until ripe.

The timber of the oaks varies greatly from species to species. The British oak is of superior commercial value, the heart wood being tough, hard, close grained, and comparatively easy to work. It excels most wood in durability, defying drought and moisture alike, and is practically indestructible under cover. The sapwood is less durable but is highly valued also. The bur oak is one of the most valuable timber trees in North America, its strong durable wood ranking next to that of the British oak. It is used extensively for shipbuilding and manufacture. The bark being rich in tannin is used for tanning leather. The timber of the white oak is adapted to the same purposes as that of the preceding trees, though it is slightly inferior. The Southern live oak produces strong yellow wood which is difficult to work; it is highly valued for shipbuilding, being very durable under water. The timber of the red oak has little commercial value, being very porous, but it is useful for making cask staves; its bark also is used for tanning. The chestnut oak yields good timber.

The galls or "gallnuts" so frequently found on oaks are produced by gall-flies, which lay their eggs in the tissues of the trees. The tissues swell up at the point of puncture and form firm nutlike structures inside of which the young of the insects develop to maturity. Each kind of gall-fly produces a different kind of gall. Oak galls are rich in tannic acid used in the manufacture of ink and the preparation of leather.

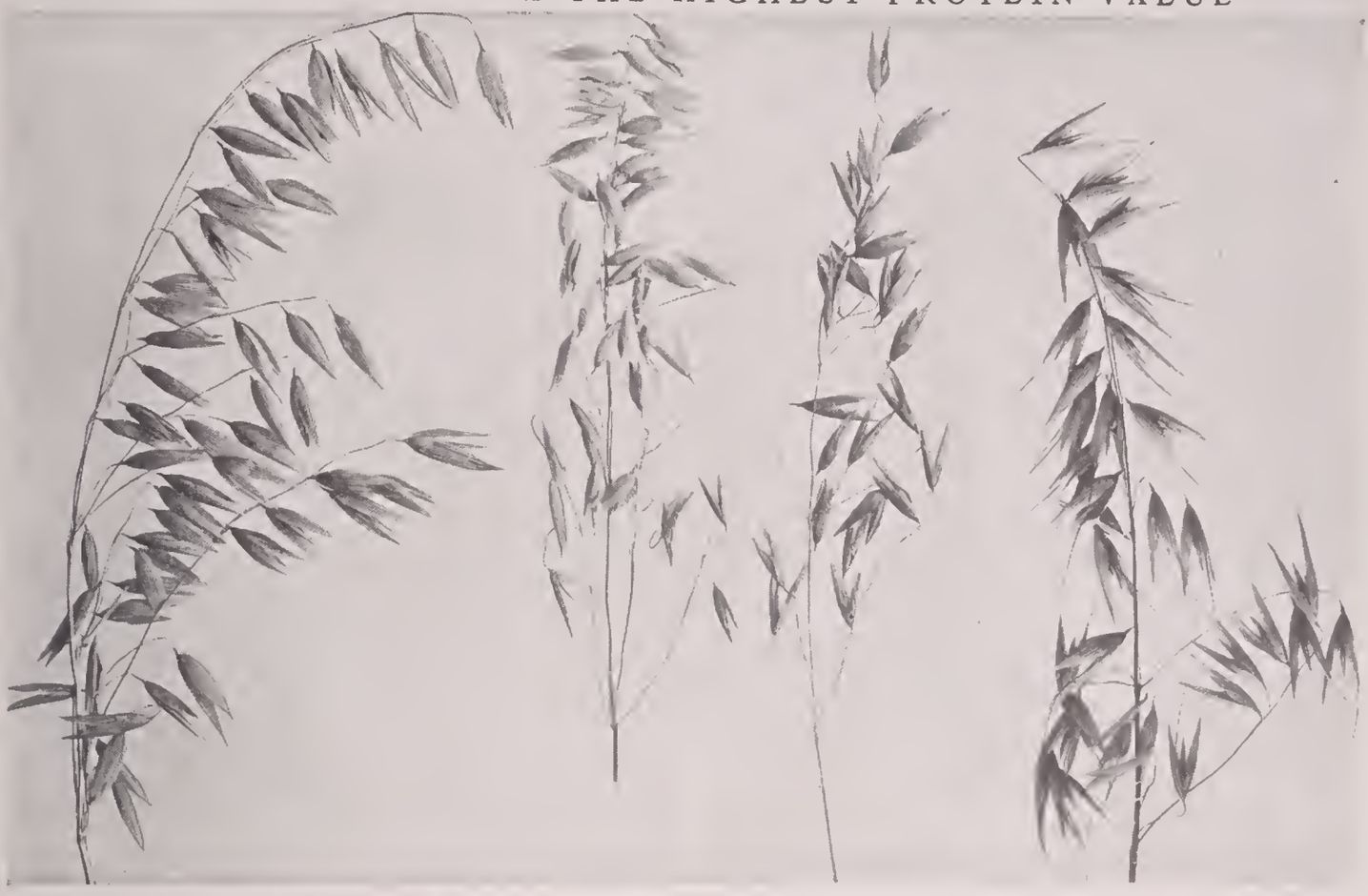
SECTION OF AN OAK GALL

You can see the hole in which the young gall-fly grew up.

Scientific name of the British oak, *Quercus robur.* The white oak is *Quercus alba;* its range is from Maine to Minnesota and southward, flourishing best on the slopes of the Alleghenies. Bur oak is *Quercus macrocarpa;* range from Pennsylvania to Montana and south to Texas, but comparatively rare east of the Alleghenies. Live oak, *Quercus virginiana* (also known as *Quercus virens*); range throughout the Southern states. Red oak, *Quercus rubra;* range from Maine to Minnesota and southward. Chestnut oak, *Quercus acuminata;* range from Vermont to Alabama and westward.

Oats. "A grain which in England is generally given to horses, but in Scotland supports the people." This is the definition of oats given in the dictionary written in the 18th century by Dr. Samuel Johnson, who often used his biting humor to express his prejudices against Scotland. "True enough," was a Scotchman's ready reply to this gibe, "and where will you

THE CEREAL WITH THE HIGHEST PROTEIN VALUE



From left to right these varieties of oats are the White Russian, Silvermine, Pherson Yellow, and Red Rust-proof. Oats are practically free from plant diseases except rust and smut. Commercially most desirable are the early-ripening varieties, like the Pherson Yellow, which often matures before the rust injures the crop.

find such fine horses as in England or such fine men as in Scotland?" Oats indeed are valuable as muscle-builders. They have less starch and a larger proportion of nitrogenous materials than wheat.

The world's production of oats is nearly equal to the production of corn and is greater than any other of the small grains. The United States in some years produces one and a half billion bushels, or about one-fourth of the world's total. The cultivation of oats is much like that of wheat. Two or three bushels are sowed to the acre (half as much, if drilling is practiced), while the average yield is 30 to 40 bushels. Oats will grow on poorer soil and in wetter, colder climates than other grains, the hardy varieties growing almost up to the Arctic Circle. In the bleak climate of northern Scotland, Alaska, Russia, and Siberia oats are a staple food crop. They do not flourish in warm arid regions such as the Mediterranean countries.

The wild parent variety from which the cultivated oats were developed cannot be located with any certainty. Very often wild oats are merely runaways from cultivation; they are distinguished by the small shriveled grain with long coarse "awns." The cultivated variety originated apparently in central Europe and was not known to the ancient Egyptians, Hebrews, Greeks, and Romans. Oats were known at first as "pillcorn" in England.

In warm regions where the heads do not fill out, oats are grown for pasture or for hay. Wild varieties are sometimes grown for such purposes. Oat straw is fed to stock and used as stock bedding and fertilizer. It is also used extensively in paper-making, for packing, and for stuffing mattresses. In the manufacture of breakfast foods the by-products such as hulls, bran, middlings, and "oat dust" are sold to stockmen for mixing with other feeds.

The oat is a cereal grass of the genus *Avena*. Wheat, rye, and barley are members of one subdivision of the grass family bearing their seeds in spikes. Oats stand alone—the grain with a loose, branching head, having separate kernels. There are two main classes of oats—the spreading oats with a head branching in all directions, and the sided, mane, or banner oats with the kernels waving loosely from one side only of the stem.

Many varieties of oats are cultivated commercially. They differ principally in the form, color, or thickness of the grain, in the length of the straw, and in the time needed for ripening. All varieties of oats are hardy, and are practically free from animal or plant diseases except rust and loose smut. To avoid these diseases scientists have developed "early" varieties which ripen before the rust seriously injures the crop. The early kinds also are shorter, and so are not so easily blown down by storms.

OBEDIENCE

WE LEARN to rule by learning to obey. One of the wisest sayings of one of the wisest men was that we learn to command Nature by learning to obey her, and the progress of the world has proved it true. If we would have power, we must first obey.

Of all the things we learn, this is the first; we could not live at all without obedience. There are creatures born into the world with an instinct that is almost knowledge, by which they do the right thing the instant they begin to move; but no child was ever born like that. We are helpless from the beginning; for years we look upon the world with wonder but without understanding, and we owe our safety, our happiness, our lives, to our obedience in those days to those who know better than we.

We must not allow ourselves to be led astray into thinking that obedience is something to be ashamed of. Nothing can exist without it; it is the only law by which a house or a business or a state can be maintained. It runs through the life of the nation. We must obey those in authority in our homes, and they obey the laws passed for us all. Not even the President is outside obedience, for he obeys the laws by which he holds his power, and he would be impeached and cease to be President if he disobeyed the clear law of the land.

Nothing else is possible either in war or in peace; we must trust the men we elect to govern us. We cannot all have equal knowledge. We set this man to find out that, that man to find out this, and then we act accordingly. Obedience is simply the way in which we recognize that knowledge is power. If a hundred men want to go to a certain place, and one man knows the way, the ninety-nine follow him. It is the quickest way of getting there. We are learning that the lives of all of us are like a great machine, of which we are separate parts. We call the machine Society. If some little part breaks down, Society is hindered just a little; if a big part breaks down, Society is hindered more; if something tremendous happens, like a nation-wide strike of railwaymen or engineers, Society seems to be breaking down in a hundred ways. Obedience is the recognition of these things.

We must be ready to serve in the place we are best fitted to fill. If the best thing we can do is to go to Congress, let us go to Congress; if we are at our best in sowing potatoes, let us sow potatoes. There is no future for those who are ashamed of service. He who does a thing best will surely come to control it, and those who watch him and obey him will surely learn his ways. We need not be ashamed to take our place, or be afraid of those above us. There is room in Society for everyone, as there is room in a body for all its parts. It was Michelangelo who thought out the dome of St. Peter's, who saw in his great imagination, as he walked about Rome, that noble edifice up there; but his dome would have come clattering down if the men who laid the stones and climbed the ladders and drove in the nails had not worked well.

It is said that a telegraph operator at Delhi saved India in the great Sepoy mutiny of 1857. He kept his head and sent his last message through: "Native troops in rebellion, murdering Europeans; all arms in their possession." He was obedient to his highest sense of duty, and he obeyed his orders whatever the hazard might be. There was a boy who was told by his father to meet him at twelve o'clock on London Bridge, and to wait till his father came. The father forgot the appointment, and as the boy did not come home, he went back and found the little man still waiting at midnight on London Bridge. He believed in his father and trusted him, and he lived to be one of the generals who saved India when the telegraph operator at Delhi sent warning. He was Henry Havelock.

There was a courtier in Persia who was talking with the Shah when a scorpion bit him. He did not flinch, and made no sign, and the king, hearing of it afterwards, sent for him. "It is an honor to talk with such a king," said the man, "and I would not allow a scorpion to break our conversation. Moreover, if I could not bear the sting of a scorpion, how could I meet the peril of the sword?" If it is an honor for a man to talk with such a king, it is an honor for a king to talk with such a man.

To know the right thing and to do it, to love truth and to obey it, to control our lives so that in all things others may have faith in us—these will bring us sovereign power, and, through obedience, lead us to command.

For any subject not found in its alphabetical place see information

LOOKOUT POSTS *for* STUDYING *the* STARS

This is the Famous Yerkes Observatory of the University of Chicago at Williams Bay, Wisconsin

OBSERVATORY. The first observatories were the ancient temple towers on the banks of the Tigris and Euphrates rivers, where the early Chaldean priests sought to penetrate the mysteries of the heavens to fix the dates of their religious ceremonies. A modern observatory with its mosquelike domes reminds us of those earliest temple-observatories, but the dome is simply a roof for the huge telescope—sometimes 60 feet long—with which the astronomer studies the heavenly bodies.

Setting the telescope for a night's work is an interesting operation. First the astronomer touches a button or lever which by means of electric motors wheels the big instrument around to the part of the sky which he wishes to study. Another lever shifts into position the dome itself, which rests on rollers, and the shutter is thrown back, opening up the slit through which we see the heavens. In the old observatories step-ladders were used to bring the observer to the eye-piece, but nowadays motors move the floor itself up or down.

To keep the instrument pointed to the star we are studying we must constantly move the telescope. This is owing to the rotation of the earth, which makes the stars appear to rise and set in the same way the sun does. But we no longer move our telescope by hand; we simply turn on a clockwork which causes the telescope to follow the star.

The combined stand and mechanism by which this is possible is known as an equatorial mounting. The telescope is fastened to a graduated circle, called the declination circle. The axis of this circle is attached at right angles to the axis of another graduated circle called the hour circle. The hour-circle axis is pointed to the pole in the heavens, and the hour circle is parallel to the celestial equator. The result of this combination of axes is a universal joint, making it possible to point the telescope at any point in the sky.

We know that a watchmaker has a hard task to make an instrument that will keep accurate time to small fractions of a second. But consider that the clockwork of the telescope must be strong enough to move an instrument weighing 20 or more tons, and delicate enough to permit the astronomer to adjust it by hand so as to keep a spider thread $\frac{1}{6000}$ of an inch in diameter constantly cutting in two a star image that is $\frac{1}{2500}$ of an inch in diameter. That is one reason why modern observatories cost hundreds of thousands of dollars to build.

At five minutes before noon every day all the telegraph offices in the United States are connected with the Naval Observatory station at Washington or on the Pacific coast, and a signal is sent at 12 o'clock precisely. The observatory also furnishes correct time to ships at sea by means of wireless signals from the station at Radio, Va. This is of great importance to navigators, who cannot accurately determine their longitude without comparing their local time as learned by observations with the time of some fixed place such as Washington or Greenwich. The Naval Observatory also publishes for navigators the 'American Ephemeris and Nautical Almanac', which is the standard guide in America to the movements of the sun, moon, stars, and planets. In many observatories. special telescopes which rotate only in a north and south plane are used for making time-fixing observations. Telescopes mounted in this way are known as *transit instruments.*

A FAMOUS OBSERVATORY SEEN FROM THE SKY

This is the first airplane photograph of the Mount Wilson Solar Observatory, about 16 miles from Pasadena, Calif. This station is the home of the largest reflecting telescope in the world, with a diameter of 100 inches. There is also a reflecting telescope of 60 inches, both of these being used for the study of the stars. The two tower observatories at the left are used for the study of the sun and conditions in the solar atmosphere.

If we visit a great modern observatory, we find that besides the telescopes there are a great many other complex and interesting instruments. One of the most important of these is the spectroscope, by which we learn what the sun and stars are made of (*see* Spectrum and Spectroscope). Another interesting instrument is the spectroheliograph, by which astronomers can photograph parts of the sun that could formerly be seen only at the time of an eclipse.

In our visit to the observatory we are sure to find the astronomers spending more time at their desks than in the operation of their instruments. That is because a majority of the actual observations are now made with photographic attachments. With a photographic plate it is often possible to get results in a few minutes that would require hours to work out with observations by the eye. The camera is attached at the eye end of the instrument, and the delicate clockwork keeps the great tube pointed at the star or group of stars as long as it is necessary to get a full exposure. For several years the great observatories of the world have been engaged in a coöperative project of photographing the whole heavens. This chart of the sky, when it is finished, will comprise more than 20,000 separate photographs. A study of such photographs is of the greatest importance in astronomical work, and many new stars have been found by this means.

The most important national observatories besides those of the United States are those at Greenwich (England), Paris (France), Pulkowa (Russia), Potsdam (Germany), and Cordoba (Argentina). Famous university or private institutions in America include the Yerkes observatory of the University of Chicago (Williams Bay, Wis.); the Lick observatory of the University of California (Mount Hamilton, Calif.); the Harvard University observatories at Cambridge, Mass., and Arequipa, Peru; the Mount Wilson observatory of the Carnegie Institution of Washington (Pasadena, Calif.); the Lowell observatory (Flagstaff, Ariz.); and the Astrophysical observatory of the Smithsonian Institution. The Yerkes observatory is notable for its 40-inch telescope, the largest refracting telescope in actual operation in the world. The Mount Wilson observatory enjoys the distinction of possessing the greatest reflecting telescope, a marvelous instrument 100 inches in diameter, and another of 60 inches. At the observatory of the Dominion of Canada (Victoria, B. C.) is a reflecting telescope 72 inches in diameter. The Lick observatory was endowed by James Lick, a San Francisco millionaire, who gave $700,000 for its erection and equipment. His remains are interred in a vault under the 36-inch refracting telescope.

The word observatory is chiefly used in connection with astronomical institutions, but in modern times observatories have been built for studying also the weather, earthquakes, volcanoes, glaciers, the magnetism of the earth and many other scientific phenomena. (*See also* Astronomy; Telescope.)

WONDERS *of* LIGHT *and* COLOR IN THE SEA

THE cold blue waves of the sea, so monotonous in their restless, eternal dance, hide beauties more vivid and shapes more strange than any dry-land vista in the world. There are gardens colored like sunsets, lawns and parks of brilliant hues, wild forests of tangled seaweed waving in slow and graceful curves as the watery "breezes" sweep through their branches. There are mountain peaks and dark caves and valleys so deep that not a ray of sunlight ever reaches them. And in the midst of this strange country dwell countless creatures who never dream there is another world above and beyond their moist home.

The upper reaches of this vast underwater kingdom are easily explored. Boats with glass bottoms, set afloat in shallow tropical waters, give us glimpses of queer monsters, fish of rainbow colors, strange shells and plants growing on the ocean floor. Divers at work upon sunken wrecks come back with glowing descriptions of what they have seen. It is even reported that an artist investigating the beauties of the coral islands of the South Seas equipped himself with a diver's suit and special water-proof paints and sat 20 feet beneath the surface painting, trying to catch the true colors of the ocean scenery as the sunlight filtered down upon it through the flickering waves.

On the preceding page is a scene such as you might observe if you were lying very quiet on a bank of sea moss off one of the West Indies islands looking through the glass window of a diver's helmet. You have read the names of these queer fish on the preceding page. But do you know that those red leaves in the background are not plants at all, but colonies of animals—the Red Sea-Fan Coral? And those star-shaped "flowers" at the right are animals too—Sea-Anemones; while at the left, below the hideous Gurnard, is a Mushroom Coral between two purple Sea-Urchins—all of them animals.

If you should catch that Gurnard and take him to the surface, you would hear him grunt aloud in protest. He is one of the few fish that have voices. His curious head is protected by a helmet of bony plates, for he sometimes descends to great depths and needs protection against the water's pressure. The Gurnard can walk on the bottom with his feelers, but the Blennies above him can do better even that that. When they are washed up on the beach with the seaweed, they skip about on the sand using their breast fins as legs, and can live quite a while out of water. The Angel-Fish is a most helpless creature and very good to eat, but as he pokes his head out from his seaweed and coral haunts, his enemies mistake him for a much larger fish, not realizing that he is "all head and no tail." The Sea-Horses are such queer little animals that you must read the special article about them to learn their habits.

THE FAIRYLAND UNDER THE SEA

The sea holds marvels of life and color more astonishing perhaps than any to be found on land. Here the artist shows you a corner of the ocean wonderland. At the upper right a school of Blennies is swimming into view, while the flat Angel-Fish looks on like a sad submarine moon. Between them two Sea-Horses, gripping the kelp with their tails, are hoping their hungry foes will mistake them for bits of seaweed. At the bottom the hideous Gurnard, like an ogre in a fairy palace, is searching for food with its six feelers. On the back of this page you may read further about the crowded life beneath the sea.

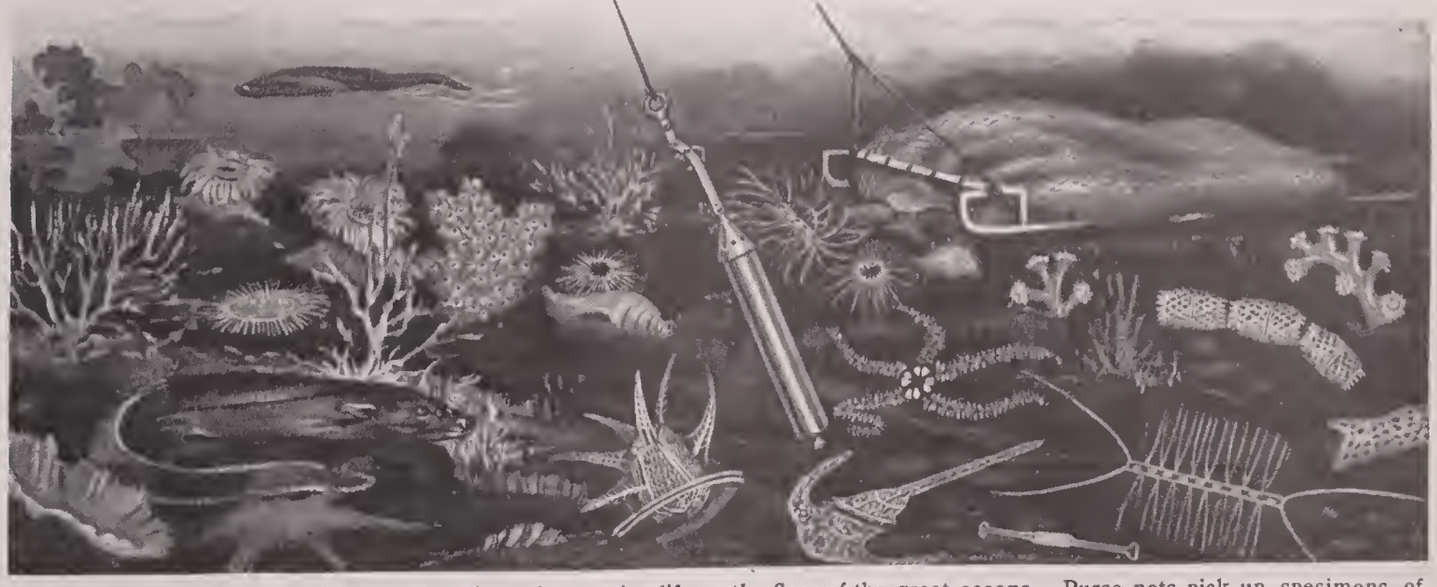
EXPLORING *the* VAST REACHES *of the* SALTY SEAS

HOW mighty are the vasty deeps that cover three-fourths of our Earth's surface! And what wonders of teeming life have inhabited and still inhabit their abysmal depths! In countless ways Oceans are the friends and servants of mankind.

OCEAN. The oceans are gathered into five great basins, and together they cover about 72 per cent of the earth's surface. If the sea were 2,000 feet deeper, and the land 2,000 feet lower, there would be nothing left on earth but a few hilltops in a vast wilderness of water, and whoever would live would have to be a sailor.

It is quite certain that most lands have been covered by the sea in past times, and some large areas have been submerged repeatedly. On the other hand we have no knowledge that any part of the deep ocean ever was land; or that any existing land ever was beneath the deep ocean. Most of the limestone, sandstone, and shales of land areas were deposited as sediment on the bottom of shallow seas. Chalk, such as that found in England, Texas, and Kansas, was deposited on the bed of a sea, and is made up of the shells of tiny creatures of the sea, billions and billions of them dying from generation to generation and sinking to the ocean bed to form deposits of chalk. We know that during several periods of the earth's history large parts of North America were covered by the ocean and some people have believed that the site of the Atlantic Ocean once was occupied by a continent, which they called Atlantis.

The seas as we know them, with their present coasts, belong to the modern era of the earth's history. Of the five great oceans, the Pacific Ocean is the largest. It has an area of more than 60,000,000 square miles, and covers a larger surface of the globe than all the continents combined. In some parts it is over 30,000 feet deep. The Atlantic Ocean is smaller than the Pacific (34,000,000 square miles), and the Indian Ocean is about half as large as the Atlantic



Here is one of the ways in which we learn about the teeming life on the floor of the great oceans. Purse nets pick up specimens of animals and plants, and ingenious plumb lines bring samples of soil and water from the depths.

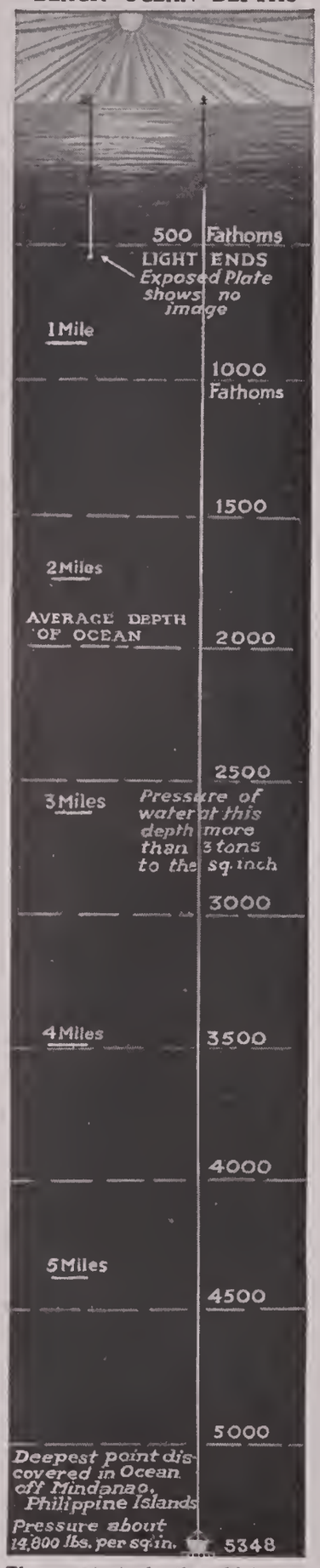
(18,000,000 square miles). Both the Arctic and Antarctic (or Great Southern) oceans are much smaller, but the figures are uncertain, as large areas are unexplored. These oceans are largely frozen over in winter and the ice melts but partially in summer. The width of the Pacific is 9,400 nautical miles between Panama and the Philippines; while the greatest width of the Atlantic, between the African coast and the La Plata River is 3,700 miles.

The waters of these oceans cover nearly three-fourths of the earth's surface, or about 140,000,000 square miles; and their volume is 14 times that of all the land above sea-level. Their average depth is about 12,000 feet. The whole volume of water in the oceans, if it were to be frozen into one ball, would form a globe 850 miles in diameter. There are oceanic areas as large as the United States where no soundings have been taken; but we know that the beds of the oceans are not so varied as the surface of the continents, though they have their mountain ranges, elevated plateaus, and vast lowland plains. They are, for the most part, without the hills and valleys which characterize the land.

All the water in all the seas is salt, the salt in it being precisely the same salt as we use in our food. Mixed with it are numerous other minerals. In a gallon of sea-water there is a little more than a quarter of a pound of common salt. The water of our Great Salt Lake and the Dead Sea of Palestine contains much more salt, gallon for gallon. In every cubic mile of sea-water there is something like 100,000,000 tons of salt—all of it washed out of the land by the streams and rivers that flow forever to the sea. At the rate at which salt is now carried to the sea by rivers, it has been calculated that it must have taken some 300,000,000 years for the rivers to carry to the seas the salt which they now contain. If the salt could all be extracted from the sea and dried, there would be enough to make a layer more than 100 feet deep over the whole earth.

The water of the oceans contains most of the mineral substances in the crust of the earth. Even when we cannot extract them we find them in seaweeds and sea creatures that have taken them from the sea. Silver has

BLACK OCEAN DEPTHS



The greatest depth which any diver has reached is less than 300 feet, about 48 fathoms. Nor is there hope of going much deeper with the apparatus now at the diver's command.

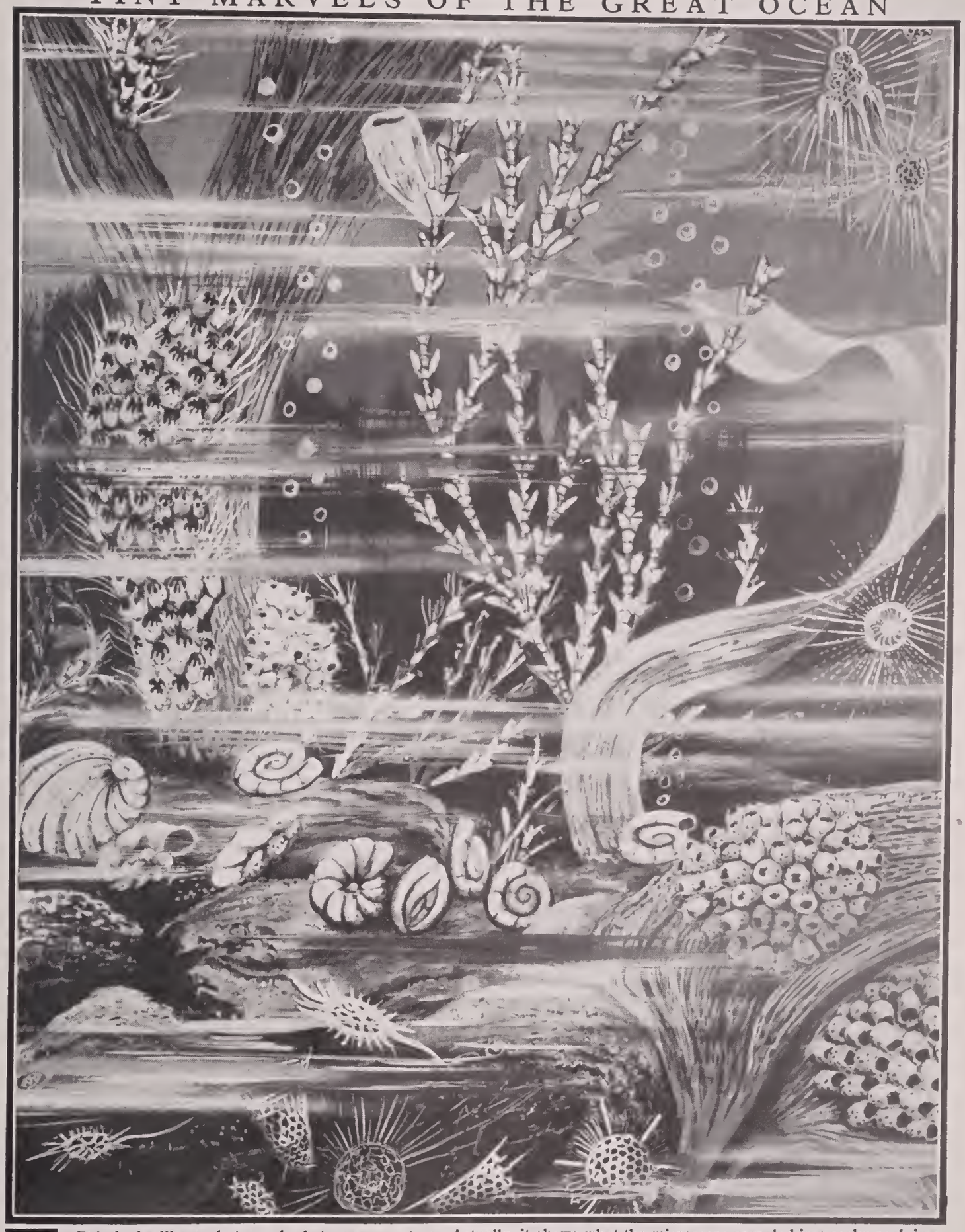
been extracted from the sea by the bottoms of ships sheathed with copper, and it has been estimated that there must be many tons of silver in the sea. Many companies have actually been formed to try to obtain gold from seawater, but none of them have succeeded.

Even the depths of the sea have not been too dark and inaccessible for scientific exploring, and we know much of the life of the ocean bottom. We know it because there are men who spend their lives exploring the lengths and breadths of the mighty oceans. Looking at it from the shore, the sea does not seem to be very mysterious, and a child would hardly guess that the wide blue surface of foaming water conceals so great a variety of life. Marvelous indeed is the thought of life miles down in the sea, when we remember that creatures living there under pressure equal to that a man would bear if he were lying under 20 railway trains loaded with iron bars.

Man has not been down to the bottom of the deep ocean; for the greatest depth divers have reached is little more than 275 feet below sea-level, and there are places in the ocean more than six miles deep. Man has risen high into the air, has cut out vast cities in the coal under the surface of the earth, but the deep sea checks him; the pressure of the waters is greater than the human frame can bear. The boldest diver dare not descend more than 90 yards below the waves—90 yards out of 10,000—and even this little journey into the water-world is full of peril for man, though little fishes make it every day. The first man to go down 90 yards into the sea was protected with a metal helmet and a metal breastplate, and air was pumped down to him by six sailors, but he had a terrible struggle to get back alive. The undercurrent of the bottom of the sea swung his life-line about and entangled it, so that he could not reach the surface, and for 20 minutes he fought for his life in the ooze and darkness. Then, after 90 minutes of struggle, they raised him slowly to the top again.

Imagine the weight of the Atlantic Ocean at the depth of a mile or two! With 2½ miles of water over their heads human beings would be crushed, if let down suddenly. On each square inch

TINY MARVELS OF THE GREAT OCEAN



This looks like a photograph of strange monsters. Actually, it shows what the microscope revealed in a rocky pool, in a spot only as large as the small square at the left. Most of these creatures are so small that the naked eye could not perceive them, but a powerful microscope reveals them in all their fascination. With the aid of modern instruments we are gradually learning more and more about all the strange forms of animal and plant life in the seas, and to read the story of evolution—a story which began hundreds of millions of years ago in ocean waters. It is from creatures such as these that scientists are slowly putting together the story of how higher forms came into existence, for many of them are the present-day descendants, practically unaltered in forms and habits, of the first forms in which organized animal and plant life appeared on our planet. Truly, the ocean is a fascinating book of life, when even little drops of water hold such wonders as these.

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of their bodies there would be a pressure of over 2½ tons. But it is man's way to overcome difficulties like this, and where he cannot go himself he sends his scientific messengers in the form of instruments.

Even with these, however, our knowledge of ocean depths has been built up slowly and in curious ways. One of the first ocean explorers filled a glass tube with air, sealed it, wrapped it in thick flannel, and put it in a copper tube, making tiny holes at the top and bottom of the tube so that water might enter. Then he sent the tube, filled with air, down 12,000 feet. When it came up the thick copper tube was pressed flat, and the glass was reduced to powder. That was the experiment which revealed the fact that the pressure on every inch of the body of a creature at the bottom of the Atlantic is about 25 times greater than the power of a railway engine.

From all this experience men for a long time believed that there could be no life down in the ocean depths. No sunlight ever reaches more than a few hundred feet below the surface, and where there was no sunlight, it was argued, there could be no plant life. Where there was no plant life there could be no animal life, and so the great floor of the ocean, it was reasoned, must be a desolate region of emptiness and death. But then a strange thing happened. A telegraph cable in the Mediterranean broke at a depth of more than 7,000 feet and when the broken ends were raised it was found that the cable was overgrown with an astounding variety of living creatures. It was certain that they had been alive in the dark and icy cold of the sea bottom, with tons of water bearing down upon them.

Investigating the Great Depths

Now men have devised new means of reaching the ocean depths. They let down nets and iron hooks; instruments for measuring the temperature of the water; and bottles which open when they touch the bottom, fill with water there, and then close so that water at higher levels cannot enter. They make great nets which touch the bottom of the sea and close up tightly as soon as they are raised above the floor. In them are brought up from the bottom countless living creatures from a realm unseen by man.

And what men find is that in this kingdom of the deep sea—a kingdom of darkness and almost freezing cold—is a great variety of life. The floor of the sea, it may be said, is like a living garden planted by Nature herself. Blind crablike forms crawl in and out of the strange undergrowth, but other creatures there are that not only have eyes, but shine with a soft dull light. There are, indeed, myriads of tiny living lamps that swim about illuminating the ocean-bed.

Explorers declare that on some parts of the floor of the sea there are millions of little creatures that shine like glow-lamps, and the discoveries that have been made in this direction are among the most interesting of all. When we make light by burning coal or gas or chemicals or by passing a current of electricity through the filaments of a lamp, we waste most of the energy in heat; only a little of it is transformed into light. But the phosphorescent light of deep-sea creatures—like the light of the firefly—is made without waste of heat. It is pure light, and a huge fortune awaits the man who can discover the way to make light in this way. Even some sharks are able to light up their paths through the deep sea with a white and heatless radiance. Certain glands in their skin give out a sticky substance, and it is this substance that makes them shapes of living light. It is doubtful, however, if the shark ever penetrates to the deep ocean beds, and it is the deep-sea animals which are most phosphorescent.

Animals can live under the great pressure of the deep sea because the pressure inside their bodies equals the pressure on the outside. A tin can could never be crushed by pressure from without if the pressure outward on the inside was equal to the pressure in from the outside.

The Curious Danger of Falling Up!

But though the inhabitants of the ocean abysses are able to live under an enormous load of water, they are liable to extraordinary accidents. If, in searching for food, they rise a considerable distance above the floor of the sea, the gases of their swimming bladders expand, and they become lighter. Up to a certain point the muscles of their bodies can resist this strange tendency to go floating upwards; and the deep-sea fish that has not completely lost control of itself can win its way back to its home in the dark cold heavy water. But if it travels too far towards the world of sunlight, its muscles are not strong enough to drive the body down. The fish continues to swell, and is gradually killed in its long and strange voyage to the surface of the sea. Thus the deep-sea fishes are exposed to a danger that comes to no other animal in the world—the danger of tumbling upwards! That such accidents do occasionally occur is shown by the fact that some unknown kinds of fish, now known to be deep-sea forms, were found floating dead on the level of the ocean long before men dreamed that life could exist at such depths. When brought up suddenly from great depths, animals sometimes explode because of the expansion of gases within the body when pressure from the outside is greatly reduced.

The great problem which has perplexed the explorers of the deep sea for many years is the question of how life is maintained so far below the waters. What do the creatures of the abyss feed upon? It is clear that they cannot keep up life merely by eating one another, for this would mean that the biggest would eventually swallow all the rest, and then die of starvation because there was nothing more to eat. All animal life must have plant life to feed on. This is as true of the wild strange animals of the deep as of the cattle of our pastures. But we have seen that no ordinary plants can grow in the sunless underworld of water. How, then, is animal life maintained there?

THEY CARRY THEIR SEARCHLIGHTS WITH THEM

Scientists have thus far, in spite of all their knowledge, been unable to produce light without at the same time wasting much energy in producing heat. Man could save millions if these fish that dwell in the great ocean depths would teach him the secret of their phosphorescence. It seems strange that many deep-water fish thus always carry a light with them, when many other varieties have not even eyes.

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A few years ago no man was able to answer this question properly, and it was not until great progress had been made in the study of those microscopic forms of life that the secret of the ocean abyss was fully revealed.

When a sailor is voyaging across the sea, he may think he is sailing through an almost barren waste of waters. But he is actually floating over the richest territories of the earth, and beneath his ship is a wealth of life more abundant than the most luxuriant forest. Below him may be miles of water, and every cupful teems with life! Nothing living may be visible, yet every cubic yard of the upper sea contains enormous numbers of living things. Some of these tiny forms of life are animals, and others are plants; but many of these plants move about like animals. They possess tiny hairlike cilia, by means of which they row about the seas. It would be amazing to see a cabbage or a rose-bush get up and move about a garden, but it is still more amazing to find that the very lowest form of plant life can travel through the seas with ease. The name *plankton* is given to all these tiny plants and animals which live in and are carried along by the currents of the ocean. Some of the little moving creatures are so small that they escape through the finest net, and some are seen only under the most powerful microscope.

The Diatoms and the Pastures of the Sea

Though these living plants are rovers, ever moving through the sea, an amazing thing about them is their power of building houses for themselves. They build around themselves shells or "tests" of most beautiful pattern, shells so small that if you look at a glass of sea-water containing many of them the water seems clear. These minute plant-cells, which build shells for themselves out of mineral matter dissolved in the sea-water, are called *diatoms*. They are really a kind of seaweed. One of these diatoms, living in the mud, has a shell fashioned like a tiny double-stemmed boat, and can travel about from place to place by means of some power quite unknown. Men of science have spent much time studying these tiny plants; but no explorers of the seas, and no student of ocean life, has found out by what power they move.

Now it is these diatoms which make the sea a pasture. They are to the fishes and animals of the ocean what the grass is to the cattle in the fields. They live in the surface waters, where they can use the sunlight in building up their bodies. They are like little chemical factories, employing the heat and light of the sun in making food from the minerals dissolved in sea-water. They multiply at an astonishingly rapid rate, and when they die their bodies fall into the depths of the ocean and provide food for the animals there. There is, in fact, a continual rain of diatoms falling from the sunny surface waters on to the dark cold bed of the sea, this rain of food apparently being greatest in the early spring and in the autumn.

Besides the diatoms, there are many other minute organisms in the sea. Some of them are tiny animals with shells that fall through the ocean and form a thick gray ooze miles below the surface. There are also many organisms which have no shells. Some of these shine in the dark, as the deep-sea fishes do. To the man of science the strangest and most wonderful of all these organisms are those sometimes brought up with the ooze of the abyss, which need no sunlight, and grow best in the cold darkness of the underworld.

The life of the oceans is most abundant in the surface waters down to about 600 feet, is less abundant in the intermediate depths, and becomes more plentiful at and near the bottom. A whitish or grayish ooze covers about a third of the ocean bottom, and there are vast areas of red clay formed by the decomposition of shells and of pumice and other volcanic materials, and of wind-blown dust. There are extensive "continental shelves," over which the water is shallow, covered with gravel, sand, and silt carried to the sea by the thousands of rivers which ceaselessly pour their floods into the oceans.

Enormous Fish Population of the Sea

If we consider merely the quantity of living matter in the oceans, the mind staggers before it, but a few figures help us to realize it. It was estimated a few years ago that in the small North Sea which sweeps the English coast there were then 10,000 million fishes, and there is a record of a fishing fleet that once ran into a school of mackerel 50 miles in circumference. What helps us most to form some notion of the number of fish in the sea, however, is the number of eggs that fishes lay. Even a sprat deposits about 5,000 eggs, and in the roe of a female cod are found some 8,000,000 eggs. A common herring lays about 25,000 eggs, and a big halibut 3,500,000, while the turbot is authoritatively calculated to lay no fewer than 14,000,000 eggs. Imagine the number of fishes in the sea laying eggs at this rate, and we can understand that, however much is taken from the sea, its mighty population is not likely to diminish.

The principal circulation of the ocean waters is maintained by three factors: (1) winds, (2) unequal temperatures, and (3) variable saltiness of the water. Of these three factors the winds are the most important, and are the chief cause of ocean currents. In equatorial regions the prevailing winds over the ocean are easterly winds, and the equatorial waters are drifted westward under their influence. As this moving surface water strikes the continents—as, for example, South America—it is divided, a part of it being turned northward and a part southward. That turned northward becomes the Gulf Stream of the North Atlantic. The corresponding current in the Pacific Ocean is the Japan Current. These warm currents of ocean water moving northward warm the air over them, and in middle latitudes this warmed air is carried over to the continents on the east sides of these oceans, because in these latitudes the prevailing winds blow from the west. This is one of the reasons why Scandinavia and Alaska are so much warmer than the same latitudes on the east sides of the continents.

From the large bodies of ice in the polar regions, large volumes of ice cold water are poured into the oceans. These cold waters move southward along the east sides of continents, but presently sink beneath the surface. These great supplies of cold water from the polar ice keep the temperature of the ocean low. The temperature of the great body of the ocean is below 40° F., though the surface waters, especially in low latitudes, are much warmer.

The warm currents in the oceans give rise to fogs which are very troublesome to navigation. The warm air over the Gulf Stream, for example, is heavily charged with moisture, and when it is carried by the winds beyond the Gulf Stream over colder waters, the moisture in the air condenses and forms fog.

Pure sea-water is a light shade of blue; but it sometimes is a shade of green or brown, owing to foreign matter or plants and animals floating in it.

The water evaporated from the sea is borne to the land, and some of it is condensed and falls as rain or snow. More than 6,500 cubic miles of water falling on the land is yearly sent back to the sea by rivers, carrying with it salts and earthy matters. The saltiest waters are found where evaporation is the greatest, for example, in the Red Sea, and in the trade-wind regions of the ocean basins. Owing to the constant circulation in the ocean, oxygen and other gases of the air are carried down to the greatest depths; thus animals and plants may flourish throughout the whole extent of the ocean.

O'CONNELL, DANIEL (1775–1847). Throughout the 18th century Ireland was badly treated. Roman Catholics were debarred from politics (*see* Ireland). Protestant landlords, most of them in England, lived on a hard-pressed Irish peasantry. Severe statutes prevented Irish manufactures from competing with English. In 1782 the Irish Parliament had been allowed real powers, but after the Irish rebellion of 1798 it was bribed into accepting the Act of Union with Great Britain (1800) by which Ireland was left only with representatives in the British Parliament at Westminster.

Daniel O'Connell was a successful Irish lawyer, himself a Catholic, who undertook to remedy this condition. He set about uniting the several divisions of the Catholics upon a political program, which included the right of Catholics to sit in the British Parliament, from which they had been excluded since the 17th century. He gained the support of the priests and organized the peasantry in 1823 in the Catholic Association, the dues of which were only a penny a month. The people joined by tens of thousands and the money raised was used to support Irish agitation. Within a year the association became a powerful political force. It did not matter that the government passed a bill suppressing the association. O'Connell then formed a new society avowedly "for the purposes of public and private charity." Great meetings were held all over the country. O'Connell ventured to run a candidate for Parliament against the powerful Beresford family and beat them. An 11 days' meeting of the peasantry and of Catholics all over the island alarmed the English government, who feared revolution. The Duke of Wellington, who had consistently opposed the Irish claims, now as prime minister agreed with Sir Robert Peel, his chief colleague, that it was better to give the Catholics practically complete rights of voting and holding offices than to risk war. This they did by the Catholic Emancipation Act of 1829, a measure which greatly angered many of their Tory supporters. Similar relief had been extended to Protestant "dissenters" the year before.

But Catholic "emancipation," like so many concessions to Ireland, was 30 years too late. Ireland remained unsatisfied. O'Connell spent the rest of his life in agitation for a repeal of the Act of Union, that is, for the restoration of an Irish Parliament at Dublin, or for what is today called Home Rule. He also sought laws which would insure the rights of the tenants against their landlords, and relieve Catholic peasants of the obligation of paying tithes to the English church. In this last he was successful (1838), but in little else. His great work was done in 1829. He had done much more than emancipate the Catholics. He had roused up a discouraged and cowed people and thus prepared the way for later leaders of Ireland.

OCTOBER. The name of this month is from the Latin *octo*, meaning eight; it was the eighth month of the year at Rome, but became the tenth when the beginning of the year was changed from March 1 to January 1. At the same time it was increased from 30 to 31 days. Several attempts were made to rename the month in honor of one or another of the emperors, and also in honor of Faustina, wife of Antoninus Pius; but those changes did not last.

OCTOPUS. These hideous sea creatures of the cuttlefish family are named from their eight long muscular arms or tentacles. They belong to a single genus of eight-armed *Cephalopoda*, one of whose distinguishing characteristics is that it has two rows of suckers on each arm, by means of which these mollusks can walk with ease over the smoothest perpendicular rock surfaces.

The octopus, as the type of its class, possesses still another organ of locomotion—the siphon, a membranous tube connected with the large gill-cavity. When the animal is resting, the water taken in through the cavity is discharged through the siphon or funnel without effort; but by forcibly expelling the water, it can propel itself swiftly and, by turning the opening of the siphon to right or left, can change the direction of its course.

The octopus is often called a "devil-fish," though the term is more correctly applied to a large tropical fish similar to a skate. They often grow to great size, and have been known to seize and drown pearl-fishers who were unfortunate enough to touch them as they lay on the ocean bottom. (*See* Cuttlefish, Squid, and Octopus.)

ODES'SA. The train rolls through mile after mile of oats and barley and waving fields of golden corn or wheat until it comes abruptly to the end of the steppe, between the two great rivers, the Dniester and the Dnieper. There on the brink, looking out over the Black Sea, stands the great seaport of Odessa.

On the famous boulevard of Nicholayevsky, lined with rows of overarching trees, stands a statue of Catherine the Great, who in 1794 founded Odessa as a stepping-stone toward Constantinople. The city proper, with its masses of handsome houses, its splendid parks and pleasure grounds, its royal palace and rich suburbs, lies on a terrace. A long flight of broad stone steps leads down to the waterfront, which is pierced by six harbors where freighters, coalers, and ships from all countries used to lie at anchor before the World War and the Revolution of 1917 paralyzed its commerce. The shore is a maze of warehouses and immense grain elevators, for Odessa is one of the chief seaports for Russia and was formerly one of the greatest grain-shipping ports of the world. Business was largely in the hands of Jews, who make up one-third of the population. Sugar, wool, and flour were the chief exports, next to grain. It had sugar and oil refineries and manufactured leather, soap, and tobacco.

Odessa was the commercial capital of South Russia and an intellectual center with a splendid university. It was a hotbed of revolutionary propaganda even before the World War, and after the downfall of the czar it was the scene of much disorder and fighting between the rival revolutionary factions. When the Ukraine was established as a separate state, Odessa was claimed as a part of that republic. Population, about 650,000.

ODIN. When the long dark winter evening settles down on the Northland, the children gather around a great pine-log fire and listen to Grandmother's wonder tales of Odin, father of the gods of Scandinavian mythology.

Many, many years ago, the story runs, there arose from the center of the earth a lofty mountain, so high that it reached to the clouds. On the top of this mountain was a beautiful green plain, in the midst of which stood the shining city of Asgard, home of the gods. Chief among these gods was Odin (sometimes called Woden), who sat on a golden throne in the center of the plain, and directed the wind, the rains, and the seasons. On Odin's head was a shining helmet, and in his hand he carried a spear made from a bough of the great ash, Ygdrasil, the tree of life. Over his shoulders was thrown a beautiful mantle, the color of the summer sky, and this was trimmed with twinkling stars, for Odin was the god of the heavens. At his feet lay two wolves which he fed from his hand, and on his shoulders perched two ravens who each morning flew over the earth and brought back news of what was going on in the world.

Though Odin ruled over the heavens, the earth, and the underworld, there was one place that he could not control. This was Jotunheim, the home of the frost giants, a dreary frozen country that lay to the north beyond the seas. These giants waged unceasing warfare against the gods and men, and Odin longed for the wisdom that would make him greater than any of the giants and enable the gods to triumph over them.

The only way in which this wisdom could be acquired was by drinking from the fountain of knowledge. This Odin decided to do, and mounting his eight-legged steed he crossed the rainbow bridge that connects the heavens with the earth. At the end of the bridge stood Ygdrasil, whose roots and branches bound together underworld, earth, and heaven. This tree was always green and its leaves never withered, for its roots were watered by a stream from the fountain of knowledge which gushed forth at its foot.

He Gives an Eye for Wisdom

Mimir, an old, old giant with snowy beard, guarded the sacred fountain, and none without his consent could drink of its waters. When he saw Odin approaching he said:

"What does the father of the gods seek so far from sunny Asgard?"

"I have come to beg a draught from your well, O Mimir," answered Odin.

"Whosoever drinks from this fountain," said Mimir, "must be willing to give much in return."

"I will give whatever you ask," replied Odin. So Mimir handed him a drinking horn, saying:

"Drink, then, and the wisdom of the ages shall be yours; but you must leave me one of your eyes."

Odin thereupon drank, and forfeited his eye; and ever after there was no one in all the worlds who could compare with him in wisdom.

Though Odin was really the god of the heavens, he was ruler of the earth as well, and it was he who created men and put them on the earth, teaching them to fish, hunt, and till the soil. Being a warlike god he also taught them to fight gloriously in battle, and he sent his messengers, the Valkyries, to lead the souls of the hero dead to Valhalla, the hall in heaven of the gloriously slain. Here the departed warriors lived, reveling in those joys which had been dearest to them on earth, fighting bloody battles by day and feasting by night, their wounds healing at once.

How Wednesday Got Its Name

When his ravens would return from their flight over the earth, they would tell Odin of hard-fought battles and of brave deeds of heroes. Sometimes they brought news of the swarthy elves who lived under the earth, making wonderful things from gold, silver, and brass; and sometimes they told him that Midgard, the great serpent who encircled the earth, was lashing the waters with his tail, turning the seas into foam, and rolling up great waves that threatened to cover the land. So Odin lived, ruling the world wisely and kindly. In his honor the fourth day of the week is still named Wednesday, or "Woden's day." Odin is sometimes identified with the Roman Mercury, which explains why the French call the fourth day of the week "Mercury's day" (*mercredi*).

For any subject not found in its alphabetical place see information

ODIN BEGS A DRINK FROM THE SACRED FOUNTAIN

Odin, already the ruler of the heavens, the earth, and the underworld, seeks the wisdom which will also make him more powerful than any of the giants of Jotunheim. With him are the black ravens, Huginn (Thought) and Muninn (Memory), who kept him informed about happenings on the earth.

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Odysseus (*ō-dĭs'ūs*). One of the greatest of the Greeks who warred against the Trojans was the hero Odysseus (later called Ulysses by the Romans). He was king of the rugged little island of Ithaca, off the west coast of Greece, and when summoned to join his brother chieftains was unwilling to leave his fair young wife Penelope and his little son Telemachus while he went to battle in a foreign land. In order to escape he feigned insanity. When the prince Palamedes came for him, he found Odysseus with an ox and an ass yoked together plowing the sand on the seashore, which he had sown with salt. But Palamedes took the baby Telemachus and laid him in the line of the furrow, where the plowshare would strike him. Odysseus quickly turned the plow aside, thus showing that his insanity was make-believe.

When Odysseus saw that he could no longer refuse to go to the war he lent his aid to bring in other reluctant chiefs, among them the great Achilles (*see* Achilles). He fitted out 12 ships for the expedition, and during the war distinguished himself as the wisest advisor of the Greeks, as well as one of their bravest fighters. Well did he deserve the title of "the crafty Odysseus." It was he who devised the stratagem of the wooden horse, and he was one of the men who hid within it and thus captured the city of Troy (*see* Trojan War).

When the war was over, Odysseus with his 12 ships laden with treasures from the conquered city set sail with a glad heart. It was ten years since he had left home and he hoped now for a speedy return. But the gods willed otherwise. Little did he dream that ten years more should pass before he saw his dear wife and child again. The story of the return journey of Odysseus, of the adventures of this "much-enduring man" and his infinite resources and stratagems, is told in the great epic poem called the 'Odyssey' (*see* Homer).

SOME ADVENTURES *of the* GREAT-HEARTED ODYSSEUS

The Land of the Lotus Eaters

Hostile winds had sent Odysseus' ships wandering over the deep, and driven them to the south, far out of their course. After many days land was sighted and the waves rolled them shoreward.

The men that Odysseus sent ashore for water found an enchanting land, and friendly people who gave them the fruit of the lotus to eat. This fruit had such magical sweetness that it made the eaters forget their commander and the waiting galleys. Forgetting, too, their wives and children and native land, they wanted only to stay, eat that delightful food, and live in a blissful dream forever.

When Odysseus learned how his men had been put under that spell of forgetfulness, he went ashore with the rest of his crew. Binding the dreamers hand and foot, he carried them back to the ships. Then he spread the sails, the rowers plied the oars, and he fled so fast from the enchantment of Lotus Land that all the quiet seas were beaten into foam.

Elsewhere in this work is told the story of Odysseus' narrow escape on the island of the Cyclops; of the bag of winds given him by Aeolus; and of how he overcame the enchantment of the sorceress Circe (*see* Aeolus; Circe; Cyclops).

How Odysseus Escaped the Sirens

After these strange adventures Odysseus and his men neared the island of the Sirens. These were the treacherous sea nymphs whose sweet singing lured mariners to destruction on the cruel rocks of the island. Odysseus well knew his peril, for he had been forewarned by Circe.

The winds ceased; the sea fell quiet; the very air was so still that it seemed as though the gods in heaven listened for that celestial harmony. Melting wax, Odysseus stuffed the ears of his men; but wishing to hear the singing of the Sirens himself, and yet to escape with his life, he had himself bound to the mast. Then he ordered his men to row with great speed past the island where the fair wicked sisters twain sat on the green mead and sang. He knew that if he was lured to their land, his bones would whiten in the grass at their feet. Yet such was the charm of their voices that when their clear-toned song reached his ears he begged and commanded his men to loose him. But they, obeying his first orders, bound him yet more securely. And they never stopped rowing until that fatal shore was left behind.

Between Scylla and Charybdis

ODYSSEUS had not gone another hundred leagues before he faced another peril against which Circe had warned him. When he saw smoke above a mountain peak, heard a yelping as of dogs, and the rushing of waters in a whirlpool, he knew that his galleys were nearing the Straits of Messina, between Sicily and Italy. There the sea boiled and roared between rocky walls. On one side the sea monster Scylla dwelt in a cliff whose top was shrouded in storm clouds. When a vessel passed she stretched out six hideous heads from her cave and snatched six sailors from the deck. On the other side, across a welter of foam, rose the dread cliff of Charybdis. Here under a fig tree dwelt a still more fearful monster with one huge mouth. Thrice every day she sucked in the sea, and then belched it forth seething like a huge caldron on a fire. Any hapless passing ship with its men was hurled to ruin; there was no escape.

Choosing the lesser peril, Odysseus steered closer to Scylla. With her terrible long-necked heads, she seized six of the rowers, bore them writhing to the cliff, and devoured them while they shrieked in the death struggle. "And this was the most pitiful thing that mine eyes have seen of all my travail in searching out the paths of the sea," said Odysseus when he recounted his adventures.

The Island of Calypso

BUT still further woe awaited them, for Odysseus' men devoured the sacred cattle of Helios, the sun god, on the Isle of Thrinacia, and for this offense Zeus (Jupiter) destroyed their ship by a thunderbolt. All were lost save Odysseus himself, who floated for nine days on a raft, and on the tenth day was cast ashore on the beautiful Isle of Ogygia, far off in the western sea.

Here in this land so fair that even the gods wondered at the sight, dwelt the sea-nymph Calypso in a lovely grotto-palace. Round the cave blossomed a wood of alder and poplar and sweet-smelling cypress, and clusters of purple grapes hung over the entrance. Sparkling fountains mingled their gentle plashing with the songs of birds, and violets and mosses carpeted the ground.

But Odysseus had no mind to these pleasant sights nor yet to the sweet singing of the goddess. Eight years he dwelt here with her, sorely against his will, for she loved him and would not let him depart. She would have made him immortal if he would have remained with her forever. But he refused the boon and ever besought the gods to relent and let him return home to his beloved island of Ithaca, where dwelt the wife and child he had not seen for so many weary years.

At last Athena (Minerva) interceded with her father Zeus in behalf of the hero, and the father of gods heard her request and sent a messenger to Calypso bidding her send him thence. The nymph dared not disobey. She gave Odysseus a great ax and augers to build a raft and with her own hands wove him sails and showed him the star by which he should steer. So the great-hearted Odysseus embarked once more on his voyage.

The Lovely Princess Nausicaä

BUT Poseidon, ruler of the deep, was not yet minded to give Odysseus rest from his troubles. Seeing him near the end of his journey, he roused all the winds of heaven against him, so that he was buffeted about for many weary days. At length when his raft had been dashed to pieces, he stripped off his clothing, and swam for two days and two nights, Athena helping him, until a great wave bore him to shore on the island of Scheria, the country of the Phaeacians, a people like to the gods. Overcome with weariness and faintness, Odysseus crept into a thicket of olive trees, and lying down on a pile of leaves, fell asleep.

It happened that same night that Nausicaä, the fair daughter of Alcinoüs, king of this land, had a dream in which Athena appeared to her, telling the maiden that her wedding day was near, and bidding her arise at daybreak to wash the garments of the family that all might have seemly raiment.

Early the next morning, the clothes were heaped in a high wagon, and Nausicaä with her attendants drove out of the city to the bank of a clear-flowing stream to do their work.

When all the linen had been carefully washed and spread in the sun to dry, Nausicaä and her maidens bathed and dressed their hair. Then they ate and played games. So tall and fair and graceful was Nausicaä that when she played ball with her maidens she looked like the goddess Artemis among her nymphs.

In a mischievous mood she threw a ball so that it bounded from the rocks and splashed into the river. The girls screamed so loud that Odysseus awoke. They fled in terror as he stalked forth like a lion. He was covered with salt and matted seaweeds, and for clothing had only a leafy bough which he held before him. But Nausicaä stood firm, for she was the daughter of a king.

"Oh, maiden," the stranger said, "I know not if thou art a princess or a goddess, for never did I see so fair a flower as thou. Have pity on me and give me an old garment to cast about me."

"The stranger glowed with such beauty and grace that all marvelled at him."

When he had bathed himself, and donned one of her brother's tunics that she had fetched to the washing, the stranger glowed with such beauty and grace that all marveled at him. After the maidens had given him food and drink Nausicaä mounted her car and bade him follow to her father's palace.

A feast was spread for him in the great hall, where there was an open fire, sweet music, soft cushions, and a glitter of gold and silver. When a blind bard began to sing of the Greek heroes of the Trojan war, the illustrious stranger was overcome with emotion. At last he announced himself as Odysseus, King of Ithaca, and companion in arms of Achilles, Agamemnon, Menelaus, and other heroes of that war. There was great excitement, for everyone had heard of the brave, wise, and clever Odysseus who, by the artful trick of the wooden horse, had opened the city of Troy.

While a ship was being made ready to carry the hero-king home, Odysseus told of the dangers he had come through. Here was the hero of Nausicaä's dreams, but he was not for her! With her heart swelling in her breast she stood, tall and pale and lovely, by a silver pillar, and listened to his wild tales.

"Farewell, stranger," she said, with a touch of sadness at the thought that she would never see him again. "Remember me for a time, because thou owest thy life to me."

"All my days forevermore shall I do thee worship as a god," Odysseus warmly returned; "for thou, lady, hast given me my life."

The next evening the great-hearted king Alcinoüs put the hero on board a ship and gave him many gifts. And as the vessel went flying like a seabird over the waters toward Ithaca, Nausicaä said to herself with a sigh: "Would that such an one as Odysseus might be called my husband and abide here with me!"

Penelope and the Suitors

TWENTY years had now passed since Odysseus had set out for Troy. His son Telemachus had grown to manhood. His faithful wife Penelope still awaited him, never ceasing to pray the gods for his return. No wandering beggar came to Ithaca but she questioned him for tidings of her husband.

When Odysseus had been gone 17 years, suitors for Penelope's hand appeared. Five score and more of the nobles of Ithaca and of the neighboring islands came with their minstrels and servants, and took up their abode in the palace of Odysseus. Each one hoped to wed Penelope, so that he might rule over Ithaca and possess the flocks and herds, fields and vineyards of Odysseus. Telemachus was his father's heir, but he was but a youth, without powerful kindred to defend him. So these insolent intruders wasted the wealth of the absent king, plotted against his son, and persecuted his unhappy queen.

The wise Penelope devised a plan to delude her suitors. She must weave a winding sheet for Odysseus' age-stricken father Laertes before she could wed again, she said, and so she retired to her chamber and sat at her loom. But the web of her cloth grew not in length, for what she wove by day she raveled by night. For three years this stratagem stood her in good stead, until her wooers discovered it. More insolent than ever when they learned the trick that had been put upon them, they pressed Penelope with increased persistence to make her choice.

The Return of Odysseus

But the day of reckoning was at hand, for at last the gods had brought Odysseus safely to his homeland. That he might not be known the goddess Athena changed him into the form of an old beggar in filthy rags, and in this guise he was received in the hut of Eumaeus, a swineherd, who had been his faithful servant. Thither came Telemachus, who had just returned from a fruitless quest for news of his father. Revealing himself, Odysseus embraced his son with rapture, and then the two took counsel together how they might kill the hated suitors.

In his beggar's disguise, Odysseus went boldly to the palace. No man knew him. But his faithful dog Argus, worn out by age and neglect, recognized his master and wagged his tail in joyful greeting, just as he was breathing his last.

The unsuspecting revelers received the returned king with insults, ridicule, and violence. When they had departed for the night Odysseus and Telemachus took all the weapons out of the great hall, that the suitors might have no means of defense when the hour of vengeance came.

Then Telemachus departed to his chamber, leaving his father alone in the hall, devising plans for the morrow. Presently the wise Penelope came down to sit by the fire. Her beauty, long marred by tears and grief, was as radiant as in the days of her youth, for the goddess Athena had restored it while she slept. Long she questioned the beggar, hoping for news of her absent lord. He told her that he had recently seen Odysseus, who was now at last on the point of returning to Ithaca.

Overjoyed, Penelope returned to her chamber. She called the old servant who had nursed the hero in his infancy and bade her attend to the wants of the beggar. As the aged nurse was washing his feet she recognized a scar on his instep and cried out with joy. But the king put his hand over her mouth and bade her keep his secret.

THE RETURN OF ODYSSEUS IN BEGGAR'S RAGS

"In his beggar's disguise, Odysseus went boldly to the palace. No man knew him. But his faithful dog Argus, worn out by age and neglect, recognized his master and wagged his tail in joyful greeting, just as he was breathing his last."

The next day the wooers returned to their revelry. After the banquet Penelope took down the great bow of Odysseus from its place on the wall and declared she would wed the man who could bend the bow and send an arrow through 12 rings suspended in a row.

One after another the suitors essayed the feat and failed. Only the despised beggar was able to bend the bow and send the arrow to its mark. Then suddenly stripping off his rags, Odysseus leaped to the threshold and sent arrow after arrow whizzing among the panic-stricken suitors. The doomed fell thick, one upon another, and when his arrows were spent Telemachus brought him shield and spear. With fresh fury the king and his son renewed the slaughter, and ceased not until the last man of the suitors and their retainers was dead.

The bodies of the slain were carried out, the air was made sweet with incense, and Odysseus was clad in his royal robes. Then the old nurse was sent to Penelope with the joyful news of her husband's return.

—*Retold from Homer's 'Odyssey'.*

OEDIPUS (*ĕd'ĭ-pŭs*). Perhaps the most tragic hero in Greek legend is Oedipus, king of Thebes. His father Laius, king of Thebes, learned from an oracle that his own son should kill him; and he therefore pierced and bound the feet of the new-born babe and caused him to be exposed on Mount Cithaeron, in order that he might perish. But a kind-hearted shepherd found the child and named him "Oedipus," meaning "swollen foot." The child was brought to the king of Corinth, who, having no heir, reared him as his own son. When Oedipus was grown to manhood he learned from an oracle that he was to kill his father and marry his own mother. To escape so dire a fate he decided to leave home, for he believed that the king of Corinth was his father.

On his way to Thebes, he met a chariot in which sat an aged man. An attendant who preceded it rudely ordered Oedipus out of the way and a combat followed, in which Oedipus slew both master and servant. So the first part of the oracle was fulfilled, for the aged man was Oedipus' real father, King Laius.

About this time a terrible Sphinx appeared in the neighborhood of Thebes (*see* Sphinx). This monster put to all who passed her a riddle, and forced them to guess it or suffer death. Many were devoured, for no one was able to give the correct answer. To rid themselves of this terrible scourge, the Thebans offered the vacant throne and the hand of Queen Jocasta to whoever should overcome the monster.

"What animal," asked the Sphinx when Oedipus confronted it, "walks on four legs in the morning, on two at noon, and on three at night?"

Oedipus quickly replied: "Man, for in the morning, the infancy of his life, he creeps on all fours; at noon, in his prime, he walks on two feet; and when the darkness of old age comes over him he uses a stick for better support as a third foot."

Thereupon the Sphinx dashed herself over the rocky precipice and perished.

Oedipus then became king and was married to his mother Jocasta, thus fulfilling the second part of the oracle. Soon the country was devastated by a terrible plague. The oracle, when consulted, promised relief when the murderer of Laius should be banished. Oedipus then learned from a seer that he had fulfilled the prediction of the oracle and killed his father, and married his mother. In horror he put out his eyes, while his mother hanged herself. A blind and helpless outcast, Oedipus wandered away with his daughter Antigone, who remained faithful to him. She alone followed her blind father into exile, and cared for him until his death.

The Tragedy Continues

The tragic fate of Oedipus descended to his children. After his abdication, his two sons, Eteocles and Polynices, became joint rulers of Thebes. Eteocles, however, desiring to rule alone, seized the reins of government and expelled Polynices from Thebes. Thereupon Polynices repaired to Argos, where he married the daughter of Adrastus the king, and enlisted the latter's help against Eteocles.

Adrastus and the Argive army attacked Thebes with great valor. The loss of life was terrible. Finally Eteocles, grieved to think that all this bloodshed was on his account, offered to decide the issue by single combat with his brother. The duel took place just outside the city walls. Both Eteocles and Polynices were mortally wounded and died on the field.

Creon, brother of Queen Jocasta, now became king of Thebes. He gave Eteocles burial with royal honors, but decreed that the body of the younger brother should lie unburied. Antigone dared to defy the royal edict, and performed the funeral rites necessary to give his soul rest in Hades.

Sophocles Tells the Story

The Greek dramatist Sophocles tells the story of Oedipus and his children in the great trilogy of 'Oedipus the King', 'Oedipus at Colonus', and 'Antigone'. In this last play he gives a beautiful picture of the noble character of the heroic maiden. When Creon asks: "And thou did'st dare to disobey these laws?" Antigone replies:

> Yes, for it was not Zeus who gave them forth,
> Nor Justice dwelling with the Gods below,
> Who traced these laws for all the sons of men:
> Nor did I deem thy edicts strong enough,
> That thou, a mortal man, should'st over-pass
> The unwritten laws of God that know not change.
> They are not of today nor yesterday,
> But live forever, nor can man assign
> When first they sprang to being.

But Creon was unmoved. Even the pleas of his son, Haemon, who loved Antigone, were of no avail, and she was condemned to die by being buried alive in a cave. Haemon succeeded in entering the vault, but too late, for Antigone was already dead; whereupon he threw himself on his own sword and expired beside the body of his beloved Antigone. His mother, Eurydice, in her grief, killed herself. Thus Creon was doomed to a widowed and childless old age.

The BONNIE BUCKEYE STATE *of* OHIO

Extent.—East to west, 215 miles; north to south, 210 miles. Area, 41,040 square miles. Population (1920 census), 5,759,394 (ranking fourth among the states).

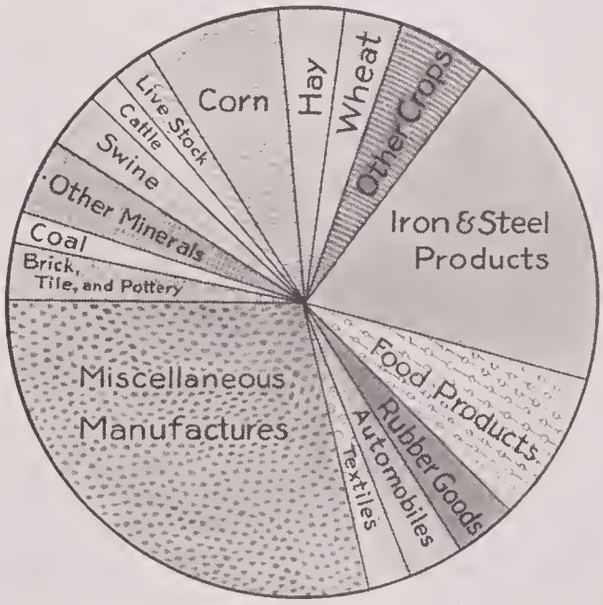
Natural Features.—Surface in southeast, hilly (part of Appalachian Plateau); western half, rolling plain (part of Central Plains); much of northwest perfectly level. Northern boundary formed in part by Lake Erie, southern by Ohio River. Chief rivers: Ohio, Muskingum, Maumee, Hocking, Scioto, Little Miami, Great Miami.

Chief Products.—Pig iron, steel, foundry and machine-shop products, rubber goods, automobiles, electrical apparatus, glassware, clay products, agricultural implements, etc.; corn, wheat, hay, oats, fruits, tobacco, live stock; coal, natural gas, petroleum, clay.

Chief Cities.—Cleveland (population, about 800,000), Cincinnati (405,000), Columbus (capital, 240,000), Toledo (245,000), Akron (210,000), Dayton, Youngstown, Canton.

OHIO. Ages ago the region that is now Ohio had been marked out by nature to become a rich and populous state. Seams of coal, beds of clay, and pockets of natural gas and petroleum were stored up beneath the surface to afford materials for great industries. The ice sheet that once covered all but the southeastern part of the state left behind the deep fertile soil that makes Ohio one of the leading half-dozen agricultural states. To the north was Lake Erie, a gateway to the Atlantic seaboard on the one hand and on the other to the iron ores of the great Lake Superior ranges; to the south was the broad Ohio River, destined to become a highway of travel and commerce leading to the Mississippi and the Gulf of Mexico.

By virtue of these and other natural endowments Ohio is today the fourth state in population, though only 35th in size; second in pig-iron production, first in clay products and fourth in coal. In total mineral production, manufactures, and agriculture it also ranks high. The first state to be carved out of the old Northwest Territory, settled by a sturdy pioneer people from the older states—especially the Middle States and New England—and receiving the cream of European immigration in the German refugees of '48—Ohio has also an enviable record of citizenship. Eight of its sons have been presidents of the United States. It is the native state of seven justices of the supreme court, two secretaries of state, six secretaries of the treasury, seven secretaries of war, four secretaries of the interior, five attorneys-general, and one secretary of agriculture. Politically, it is the heart of the country, "the state where keynotes are sounded"; and the party which carries Ohio counts with reasonable certainty on carrying the nation. The state's political ascendancy is evidenced by the fact that in 1920 three of the presidential nominees were Ohioans.



With its varied production, Ohio takes high rank among the states in agriculture and mining as well as manufacturing.

Geographical position and convenience of transportation are chief among the causes that have made Ohio great. From the days of the aboriginal peoples of America, Ohio has been the avenue of travel for all who crossed the Appalachian barrier north of the Cumberland Gap. The natural northern land routes across the eastern mountains are largely determined by the valleys of the Ohio's source streams and eastern and southern tributaries. These land and water routes, all converging toward the Lake Erie and Ohio River region, were followed by the first white settlers to the Old Northwest. Through New York State to Lake Erie, then westwardly along its shore, came New Englanders. Pennsylvanians, from the head waters of the Ohio River in their

own states, followed its course into the lower Ohio basin. Virginians and Carolinians passed from the valley of the Shenandoah through the mountain gaps into Kentucky, whence they and the Kentuckians reached southwestern Ohio.

A forest region, such as early Ohio was, is not so easy to subdue as prairie land. Yet so irresistibly did the converging thoroughfares direct the stream of immigration into the Ohio region that by 1830 it had reached its present rank of fourth in population, and had the resources within itself to make the first improvements in transportation facilities. When New York State finished the Erie Canal in 1825, Ohio was enthusiastically eager—and able—to follow its example. The importance of Cleveland began with the completion of the Ohio and Erie Canal in 1835. Toledo's growth similarly dates from the completion of the Wabash and Erie canal in 1843 and the Miami and Erie in 1845. Too shallow to carry modern freight cargoes, the Ohio canals, like most canals in the United States, are today abandoned and decayed—destroyed by neglect and the competition of the railroads. Lately, however, it has been proposed to deepen the Ohio and Erie Canal.

The first state to follow New York's example in canal-building, Ohio was likewise a pioneer in railroad construction. The same natural trend of the land that guided Indian and pioneer travel makes Ohio a great railway state today. Following the river valleys, the important northern trunk lines crossing the Appalachians converge on either the Ohio Valley or the Lake Erie basin, making Cleveland, Cincinnati, Columbus, and Toledo leading railway centers. Ohio has a greater proportion of railway mileage to area (8.39 railway miles to every 36 square miles) than any other state west of the Appalachians. In addition, a network of electric interurban lines connects the populous centers, ranking Ohio first among the states in electric mileage.

Though the railroads have killed the canals, water transportation remains an important element in Ohio's commercial prosperity. This state in the heart of the continent has four ports of entry, or customhouse ports — Cleveland, Cincinnati, Toledo, and Sandusky —through which pass foreign imports, and exports amounting in some years to more than $50,000,000. Yet the value of the foreign commerce is trifling compared with the vast flood of domestic commerce that passes through the state. Lake Erie in particular is of inestimable commercial importance in furnishing cheap transportation for bulky and heavy commodities like coal, lumber, and iron ore. Before the World War had played havoc with transportation rates, it is said that a ton of coal could be carried from Cleveland to Duluth for less than it cost to have it shoveled from the sidewalk into the purchaser's cellar window. Then, too, the Ohio River, in spite of its temperamental habits of going on a rampage in flood seasons and sulking and dwindling in dry seasons, is remarkable among American rivers for the amount of freight (an annual average of more than 15,000,000 tons) carried on the 2,300 miles of the main stream and its navigable tributaries.

A state or a country which commands coal and iron in addition to the main thoroughfares of transportation has all the material elements of greatness. Ohio,

OHIO AND ITS MANY THRIVING CITIES

Ohio might well be likened to an immense factory, with just the right amount of countryside between its many manufacturing centers to give breathing space and raise food. Located astride of the great routes of travel from the east to the central and western states, it enjoys unusual industrial and commercial advantages. The canal systems shown by the map once played an important part in Ohio's transportation, but now have fallen into decay and lost most of their importance.

AMONG OHIO'S MANY INDUSTRIES

Here are a few of the many industries which make Ohio's name known the world over. Her coal deposits furnish fuel, and the state is a famous producer of iron, steel, and machinery. It also makes some of the finest pottery in the United States. Down the Ohio River passes a vast stream of industry, including such shipments as the bargeloads of Ohio-made automobiles in the picture. Oil wells and natural gas add to the state's wealth, and the tire and rubber-goods industry, centering in Akron, markets its wares in every land on the globe.

contained in the Easy Reference Fact-Index at the end of this work

commanding all three, can truthfully claim to be, as the state motto declares, an *imperium in imperio.* The state's chief mineral is bituminous coal, obtained from the portion of the Appalachian coal field contained in the eastern and southeastern part of the state. The lean native iron ores have not been worked since the opening up of modern transportation, which brings the high-grade ores of Lake Superior district to the Lake Erie ports, there to be manufactured into pig iron or to be transshipped for that purpose to Pittsburgh, Youngstown, Steubenville, Columbus, or Ironton. Easily available limestone supplies the third essential, with coal and iron ore, for the manufacture of iron. Cleveland was for years the chief transshipping port for iron ore, but since the traffic has grown too vast for its congested harbor, the ports of Lorain, Fairport Harbor, Conneaut, and Ashtabula have sprung up to meet the need, while farther to the west Huron, Sandusky, and Toledo have great docks where ore cargoes are exchanged for coal.

Other important mineral products of Ohio are petroleum and natural gas (although the natural gas output has greatly declined and Ohio's fuel gas is now mostly piped from Virginia), clay, building stone (Berea sandstone and various limestones), sand (especially molding sand), and gravel, salt, bromine, and lime.

The most important manufactures are iron and steel from the Lake Superior ore and the various foundry and machine-shop products. Older than iron manufacture and still of much importance is the packing industry. The first western packing establishment was founded about 1818 in Cincinnati, thereafter facetiously known as "Porkopolis," and until 1850 it was the most important packing city in the Union.

Another industry notable for both age and importance is the flour and gristmill industry. In the early 19th century the flatboats and steamboats carried Ohio flour and meal along with Ohio pork and beef down the Ohio and Mississippi rivers to New Orleans. Toledo is a "granary of the country" today.

The native clay is manufactured in the state into sewer pipe, brick, tile, and pottery. Most of the pottery made in Cincinnati, Zanesville, and East Liverpool is white ware. East Liverpool manufactures nearly half of all the white granite ware and semivitreous porcelain used in the United States. The art wares of Coshocton and Zanesville and the Rookwood ware of Cincinnati are known all over the world. Canton has large factories of enameled ware, as well as all kinds of pressed metal products.

The rubber goods and cereals of Akron (*see* Akron), the automobiles of Cleveland and Toledo, the cash registers and electrical apparatus of Dayton, and the matches of Barberton are distinctive products of various manufacturing centers. Carriages and wagons, airplanes, glass, tinplate, cement, coke, and paper and strawboard are among other manufactures.

Ohio is a great agricultural state, too. The chief crops are corn, wheat, and hay, with potatoes, rye, barley, tobacco, sugar beets, and apples and other fruits as important secondary crops. Pork-raising

A VIEW OF OHIO'S NOTED STATE UNIVERSITY

University Hall, which you see here, is one of the older buildings of Ohio State University at Columbus. The university was founded in 1870. It is supported partly by proceeds from a land grant made by the Federal government in 1862, and by further annual grants since 1890, and partly by annual grants and special donations from the state.

For any subject not found in its alphabetical place see information

THE WEST FRONT OF THE STATE CAPITOL AT COLUMBUS

The Capitol was completed in 1857. It is 304 feet long and 158 feet high. In the foreground is the famous McKinley memorial designed by the American sculptor, Hermon MacNeil.

is still profitable because Ohio is in the corn belt. Much of the state is still in permanent pasturage. For a long time the commonwealth led in wool production. Now, however, the wool-growing center has passed to Western states, though Ohio is still an important producer of fine grade wools.

A romantic episode in Ohio horticulture is the story of grape culture in the state. In the first half of the 19th century, Nicholas Longworth, a Cincinnati banker and merchant, spent a fortune and 40 years of his life in the attempt to establish vineyards on the Ohio. From Bordeaux, Burgundy, Madeira, the Rhine, the Jura, and various parts of America he brought vines, but not until in 1825 he tried the Catawba vine from North Carolina did he find one that would thrive on the banks of the Ohio. Longfellow, after a visit to "the father of American grape culture," celebrated "the wine of the West, that grows by the Beautiful River." But following the destruction of the surrounding forests, mildew and rot fell upon the vineyards of the Ohio in the 1850's and '60's and exterminated them. The Catawba grape, however, found a refuge on the Ohio shores and islands of Lake Erie, where, with other American grapes, it flourishes over a total vineyard area of about 10,000 acres.

Like its manufactures, the agriculture of the state has been made profitable by the development of transportation. In the early days there was no profit to the farmer in the interior from raising anything which could not be sent part way to market—at least as far as the river's banks—on its own legs; hence the early importance of the grazing industries. Before the opening of the Ohio and Erie Canal, grains were practically worthless along its route; corn sold for 10 cents and wheat for 25 cents a bushel. Now, of course, the presence of numerous manufacturing towns and cities gives the farmer a ready market near at hand.

The foundation of Ohio's agricultural prosperity, however, was laid thousands of years ago in the Ice Age, when the Laurentian glacier rested a vast white paw over the greater part of what is now the state of Ohio, leaving its muddy footprint when it withdrew. The glacial mud and gravel chokes the ancient river valleys, and the rivers today flow in channels sometimes a hundred feet or more above their former beds. A buried channel more than 500 feet deep has been discovered near St. Paris, Champaign County. Northern and western Ohio, in preglacial times a network of river gorges and valleys, has been plastered over with glacial drift to form a relatively level plain, like "a checked and worm-eaten plank which a carpenter has filled with putty." The practically inexhaustible Ohio clay deposits are partly of glacial origin, but the glacier's supreme gift was to agriculture. The glacial soil covering three-fourths of the state includes the best Ohio farm lands. The unglaciated soil is good where it has a limestone basis, or lies in the river's flood plain, but the development of the southeastern rim of the state, untouched by the glacier, lagged behind the glaciated portion until the discovery of coal in the unglaciated region.

This southeastern rim, gradually dropping down from the Allegheny plateau region, is still rugged

and hilly, as the whole of Ohio was before the Ice Age. The Lake Erie border is circled by level plains, and a line of low hills, running from below the northeast corner to a little below the middle of the western boundary, turns the northern streams toward Lake Erie and those on the southern side into the Ohio River. When white men first saw it, all this region, except for little patches of open prairie, was overgrown with dense forests of oak, hickory, buckeye, walnut, etc. The buckeye or horse chestnut, most numerous of the native trees, gave its name to the "Buckeye State."

Famous People Born in Ohio

But after all, the pride of Ohio is not so much in its commerce, manufactures and agriculture as in its citizenship and the number and character of the noted men and women it has produced. "These are my jewels," said the mother of the Gracchi, pointing to her sons; and this is the inscription on a monument in the capitol grounds at Columbus. The list of Ohio's distinguished citizens, in addition to those who have become famous as statesmen, includes soldiers like Grant, Sherman, Sheridan, and Custer; inventors like Thomas A. Edison, C. F. Brush, and Wilbur and Orville Wright; novelists like William Dean Howells, Constance Fenimore Woolson, and Albion W. Tourgee; journalists like George Kennan, Whitelaw Reid, and J. A. MacGahan; humorists like Artemus Ward and David R. Locke (Petroleum V. Nasby); poets like Edith Thomas and Alice and Phoebe Cary; historians like W. M. Sloane and James Ford Rhodes; sculptors like J. Q. A. Ward and Hiram Powers; and painters like Frank Duveneck and Kenyon Cox.

It is not chance that has produced this splendid record. A free state by the terms of the Ordinance of 1787, Ohio from the first drew from the best elements of all the older states. Its educational and social institutions are worthy of the state's founders. The Ohio State University is at Columbus. Ohio University, at Athens, is the pioneer institution of higher learning in the "Old Northwest," and the state supports also Miami University, at Oxford. Western Reserve University, at Cleveland, has been called the "Yale of the West." Oberlin, the first coeducational college in the United States, bore a notable part in the abolition movement. The University of Cincinnati is one of the foremost municipally supported universities. Some of the city schools and centralized rural schools of Ohio are among the best in the Union. An excellent system of county school organization was adopted in 1914. Ohio has a tremendous foreign-born population, and Cleveland claims more Hungarians than any other city outside of Hungary. Though not inclined to wild radicalism, the state has been a leader in certain lines of advanced social and industrial legislation and administration, such as the promotion of safety in factories. The initiative, referendum, and recall have been a part of the state constitution since 1912.

The first settlement in Ohio was made in 1788, when Marietta, at the mouth of the Muskingum River, was founded by "The Ohio Company of Associates," composed chiefly of New England Revolutionary soldiers under the direction of Gen. Rufus Putnam. The same year saw the founding of Cincinnati, which at first rejoiced in the astonishing name of "Losantiville"—a mongrel compound designed by its schoolmaster inventor to mean "the town opposite the mouth of the Licking"—"os" meaning mouth and "L" standing for the river. In 1796 a company of Connecticut men founded Cleveland in the Western Reserve—a strip of land along the lake in the northeast which was reserved by Connecticut when she surrendered her claims to western lands (*see* Connecticut). By the end of the 18th century 15 thriving towns had sprung up, and the tide of immigration was flowing so strongly into the Ohio region and other parts of the Northwest Territory that a territorial legislature was established in 1799 (*see* Northwest Territory). In 1803 Ohio was admitted to statehood.

For many years the northern boundary of Ohio was uncertain, both Ohio and Michigan claiming a strip of land 470 square miles in extent, which included the lake port of Toledo. The controversy culminated in 1835 in the so-called "Toledo War," when the militia of both states were called out and a conflict for a time seemed imminent. The following year Congress awarded the disputed territory to Ohio and gave Michigan in compensation the rich mineral and agricultural region known as the "Upper Peninsula" (*see* Michigan).

Being settled mainly from the North and being a non-slavery state by the terms of the Ordinance of 1787, Ohio was a stronghold of the abolition movement. Large numbers of slaves who escaped across the Ohio River were aided to make their way to Canada by the system known as the "underground railroad" (*see* Slavery and Serfdom). When the Civil War broke out, Ohio played an important part in furnishing men and supplies. Her part in subsequent conflicts has also been notable.

OHIO RIVER. Of the two great tributaries that flow into the Mississippi, the Ohio, though shorter in length, is vastly more important than the Missouri. Its navigable waters traverse more than 1,000 miles of the greatest industrial and farming district in the United States, furnishing means of transportation for many of the raw and manufactured products of the region. It serves such mighty industrial centers as Pittsburgh, Wheeling, Cincinnati, Louisville, and other thriving cities and taps the extensive coal and oil fields that lie on both sides of its course. Fleets of barges and steamboats ply up and down the river, laden with coal, petroleum, lumber, grain, pottery, and iron and steel products. Two canals, now fallen into decay, once connected it with Lake Erie—the one from Portsmouth, Ohio, by way of Columbus to Cleveland, and the other from Cincinnati by way of Dayton to Toledo.

This useful and picturesque river is formed by the junction of the Allegheny and Monongahela rivers at Pittsburgh in Pennsylvania. It flows thence in a southwesterly direction until it finally reaches Cairo, where it joins the Mississippi. It forms the northwestern boundary of West Virginia, the northern boundary of Kentucky, and the southern boundaries of Ohio, Indiana, and Illinois. Its waters are gathered from the tributaries which drain the neighboring country—the Muskingum, Scioto, Miami, and Wabash from the north, and the Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland, and Tennessee rivers from the south.

In summer, away from the smoke of the bustling cities, the Ohio presents a pleasing aspect, sweeping in majestic curves through the fertile grain fields and wooded hills, turning and re-turning until its twisted course almost encircles certain spots. Numerous islands, some under cultivation, divide the waters of the shining river. Of these the most famous is Blennerhassett, connected with Aaron Burr's conspiracy, near Parkersburg, West Virginia. In early spring the red-brown waters of the mighty stream, fed by the foaming torrents that bear away the melting mountain snows, swell to an angry tide, devastating the bottom-lands and inundating lower parts of the cities.

Formerly the course of the river was impeded by falls, sandbars, and snags, and from June to November the waters were too low to accommodate craft of any size. These conditions have been gradually overcome. Canals and locks are built around the falls, the largest of which are at Louisville, Ky. Sandbars and snags have been dredged out and dams, wing dikes, and channels provide against the drought. In especially dry years, however, low water still impedes steamboat traffic. These improvements were provided for by numerous acts of Congress, that of 1908 being the most important. It sanctioned the construction of a nine-foot channel throughout the course of the river, 54 locks and dams being contemplated. The average flow is 3 miles an hour, and average volume 158,000 cubic feet a second.

It is to La Salle that we owe the discovery of the Ohio, in about 1670, when he descended the river at least as far as the present site of Louisville. Little was generally known of the river, however, until the middle of the 18th century, when it became important in the struggle for the interior between the French and English, the English eventually gaining control (1763). After 1768 settlers from Virginia followed this course into the new country. Ten years later George Rogers Clark set out from the falls at Louisville for the conquest of Forts Kaskaskia and Vincennes. In 1783 the whole Ohio country became a part of the United States and in 1787 the organization of the Northwest Territory opened the whole region to settlers. The first great tide of western immigration swept along this course. The first steamboat descended the river from Pittsburgh in 1811, and thenceforth to the Civil War the steamboat traffic of the Ohio was a dominant factor in the industrial life of the Middle West.

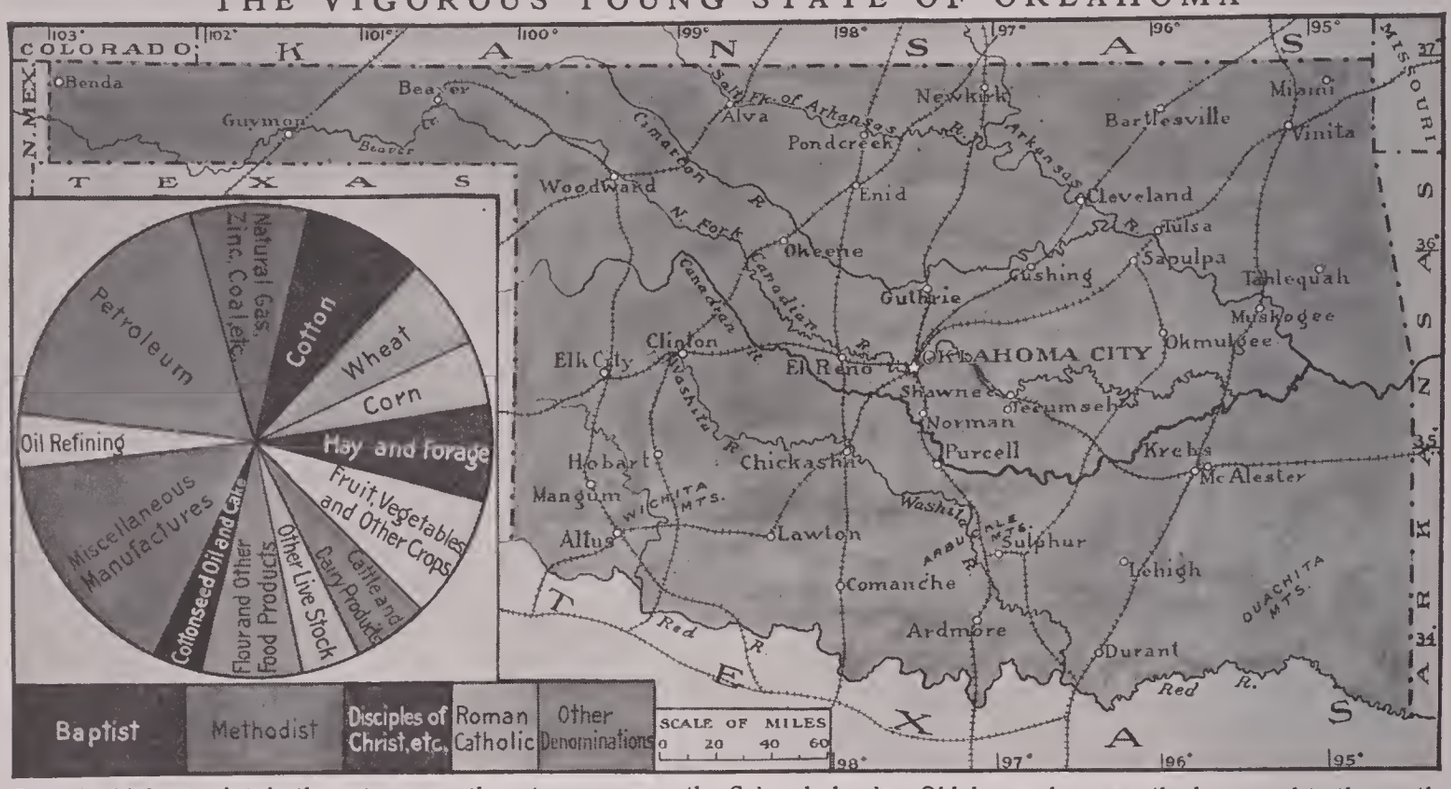
INDIANS *and* WHITES *in* OKLAHOMA'S HISTORY

OKLAHOMA. Youthful, vigorous Oklahoma—it sprang full-grown into being! For half a century the tide of white immigration surged about its boundaries without being able to enter; and then in 1889 the Federal government first opened the gates, and the flood poured in. Until that date the entire country was known as "Indian Territory"—a country reserved as a last home for various tribes of redmen who had been driven from the Southern and Western states. Only a small portion in the center remained unassigned to them—the original "Oklahoma," which in the Choctaw language means the "Land of the Red Man." Toward this portion of the public domain the whites cast covetous eyes, and finally Congress set April 22, 1889, as the day upon which white settlers might enter to stake out homestead and other claims.

Extent.—East and west, about 470 miles; north and south, 230 miles. Area, 70,057 square miles. Population (1920 census), 2,028,283.
Physical Features.—Rolling plain merging in the Great Plains in the west; Ozark Mountains in northeast, Washita (Ouachita) in southeast, Wichita in southwest; Red River (forming southern boundary) and its tributary, the Washita; the Arkansas and its tributaries (Canadian, Cimarron, Neosho).
Products.—Cotton, corn, wheat, hay, kafir corn, potatoes, flax; oil, gas, coal, lead, zinc, granite; live stock and dairy products; flour, cottonseed-oil, and oil cake.
Chief Cities.—Oklahoma City (capital, about 95,000), Tulsa (75,000), Muskogee (32,000), Okmulgee, Enid, Shawnee, Bartlesville, Ardmore.

For weeks home seekers had been gathering, and on the great day thousands of human beings were massed along the frontier, kept back from the promised land by troops of the United States army, waiting for the gunshot which should start the race for land. Some had put all their money into obtaining the best horses they could find, and were mounted and ready. Some were lucky enough to have passage engaged on the Santa Fe railroad, the only line that then penetrated the Oklahoma country. Others were in carriages, or on ponies and mules, and many were afoot. Families

THE VIGOROUS YOUNG STATE OF OKLAHOMA



From its highest point, in the extreme northwest corner, near the Colorado border, Oklahoma slopes gently downward to the south and southeast, where the Red River reaches the Gulf Coastal Plain at an elevation of only about 400 feet above sea-level. This great shelving plain is broken by a few highland areas—the Wichita Mountains in the southwest, the Arbuckle Mountains in the south central portion, and the Ouachita Mountains along the eastern border. The entire southern boundary is formed by the Red River. At the left of the map you see how the chief products of the state rank, and the leading religious denominations.

who had been living for weeks in their canvas-covered wagons tied their belongings tightly on and waited with reins grasped ready for the dash. Before the gunshot smoke had cleared away the leaders in the "Oklahoma run," as it was called, were almost out of sight. The multitude followed, spreading out over woodland and prairie, staking their claims here and there. On that first day Guthrie and Oklahoma City were born. Towns sprang up between breakfast and supper, and in a week a new commonwealth had been created. Settlers continued to pour in from neighboring states, but for nearly a year there was no government, until in March 1890 the western half of the present state was organized as the Territory of Oklahoma.

THE STATE CAPITOL AT OKLAHOMA CITY

The progressiveness of this youthful commonwealth is well symbolized by the magnificence of the building that houses its governmental machinery.

From then on, Oklahoma grew with a rush that reads like a fairy story. New areas were opened for settlement at various times, and the population increased at an extraordinary rate. To increase the land available for settlement the Federal government made individual allotments to the Indians and bought the surplus land in their reservations—much of it for as low as 15 cents an acre. Several more "runs" occurred, until the competition for the claims became so keen that it was decided to assign them by drawing lots. Oil fields had been discovered in Indian Territory, the eastern half of the present state, as early as 1890, but there was little attempt at development until 1903, when the big "oil boom" began. After years of agitation for statehood, Indian Territory and Oklahoma Territory were admitted to the Union as the 46th state on Nov. 16, 1907.

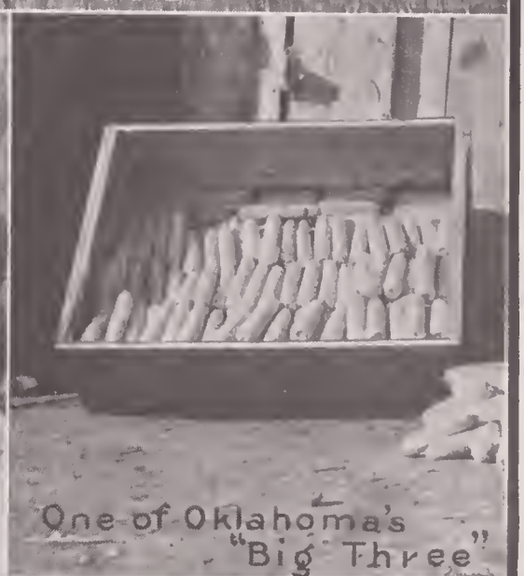
As is indicated by the eastward-flowing Arkansas and Red rivers, the surface of Oklahoma is in general

PROSPERITY FROM OKLAHOMA'S SOIL

Great Wheat Harvests Throughout the State

Generous Cotton Fields

Abundant Coal



One of Oklahoma's "Big Three"

Many Fine Herds for Milk and Market

One of the World's Greatest Oil Regions

Oil, coal, and natural gas are the principal mineral products of Oklahoma. In some years the state has produced more oil than any other state in the union. But agriculture and stock raising is still the most important industry, its total products being worth, roughly, twice as much each year as all the minerals produced.

contained in the Easy Reference Fact-Index at the end of this work

a gradual slope from west to east, forming a part of the great Mississippi Basin. At the western end of the long "Panhandle," where the Rocky Mountain plateau enters the state, the altitude reaches 4,800 feet, while in the extreme east the valley of the Red River is less than 400 feet above the sea. In various sections this slope is interrupted by broken or hilly land—in fact, only in the western part and in a belt through the central part of the state from north to south is the surface very level. In the southwest the Wichita Mountains rise in places 1,500 feet above the surrounding lowlands, and in the middle south the low Arbuckle Hills break the plains. In the northeast the mineral-bearing Ozarks edge over from Arkansas and in the southeast the Washitas (Ouachitas) present a group of low rugged hills.

In spite of the tremendous development of petroleum in Oklahoma, agriculture remains by far the most important industry. About half of the total area is in farm land. Even the mountain valleys and the Panhandle plateau are fertile, but the latter lacks rainfall, and is used chiefly as range for live stock. Some sections that have irrigation facilities yield fine crops. Owing to the great range in elevation, temperature, and rainfall, an extremely wide variety of staples are produced by the farms. Seldom are corn, wheat, and cotton found growing side by side as important crops; but in this state they form the three chief agricultural products. Cotton is grown chiefly in the valley of the Red River, but is found to some extent almost as far north as the Kansas line. Wheat is grown throughout the state, but especially in the west and northwest; and corn thrives in almost all parts. Other important products are the prolific kafir corn, broomcorn, milo maize, oats, hay, potatoes, green vegetables, and fruits. Cattle and hogs are raised extensively and dairying is a thriving industry. The market centers for Oklahoma's agricultural district are Oklahoma City (the capital), Enid, Shawnee, and Guthrie.

Famous for Its Oil and Gas

Oklahoma is also famous for its oil and gas. In the northeastern part of the state, just west of the Ozark Mountains, one of the world's greatest oil regions was developed, which in some years has led all the other states, producing about one-third of the total United States output and about one-fifth of the world's supply (*see* Petroleum). Natural gas was also obtained in great quantities and piped to towns and cities in Kansas and Missouri, in addition to supplying more than 100 towns in Oklahoma. Much coal is also found in eastern Oklahoma, and its production is steadily increasing. In the extreme northeast are found important deposits of lead and zinc. Asphalt, clay, limestone, granite, marble, gypsum, salt, and other minerals also exist in workable quantities. These rich mineral resources of eastern Oklahoma have given rise to many large cities, chief of which is Tulsa, called the "Millionaire City" because of the many fortunes made in the nearby oil fields. Muskogee, Okmulgee, Bartlesville, McAlester, Sapulpa, and Ardmore are other cities which grew rapidly as a result of the petroleum and other mineral industries.

The chief manufacturing plants of Oklahoma are flour and grist mills, cottonseed mills, and petroleum refineries. Much of the petroleum produced, however, is carried in pipe lines to the great refineries at Whiting, Ind.

Oklahoma was all part of the Louisiana Purchase, except the long narrow strip in the northwest. This strip originally belonged to Texas, but when Texas entered the Union as a slavery state, this part of its "Panhandle" had to be ceded, because it was north of the Missouri Compromise line of 36 degrees 30 minutes of latitude. Until 1890, when it became part of the Oklahoma Territory, it was a part of the public domain not included in any state or territory, and was popularly called "No Man's Land."

The Growth of Oklahoma

The first step in Oklahoma's political growth goes back to about 1830, when the great southern tribes of Indians—the Cherokees, Choctaws, Chickasaws, Creeks, and Seminoles—were ordered to be moved to what is now Oklahoma. In 1834 this region was recognized by Congress as part of the "unorganized or Indian country." The Indians who had found a new home here were known as the Five Civilized Tribes and gave many evidences of progress, establishing schools and courts, improving their farms, and setting up governments for themselves not unlike those of the states of the Union. Many of them owned slaves, and in the Civil War troops from Indian Territory were enlisted by both sides. At the end of the war the tribes were compelled to cede back to the United States much of their western territory, and many tribes from the western plains were established there, including the Cheyenne, Arapaho, Comanche, and Pawnee.

By 1914 the work of assigning individual allotments to the reservation Indians was practically completed. There are still more Indians in Oklahoma than in any other state, and some communities have them in large numbers, although they form only a small percentage of the total population. They own many valuable oil and other holdings in the state, and among their number are many well educated and prominent citizens.

Indian Territory never had the usual territorial form of government. In the early days the Five Civilized Tribes organized for themselves systems of government similar to those of the states, with an executive chief and a legislature. They had their own courts and their own schools. In 1907, when Oklahoma and Indian Territories were admitted to the Union as one state, the enrolled membership of the Five Tribes was 101,209, of whom nearly 27,000 were full-blooded Indians. In 1914 the total property of these Indians was valued at $175,292,444.

The constitution of Oklahoma is an advanced one providing for the initiative and referendum, employ-

ers' liability, and the restriction of child labor. The University of Oklahoma, established at Norman by the first territorial legislature in 1890, is supported largely by land grants from the Federal government.

OKLAHOMA CITY, OKLA. Oklahoma City, which was settled by 3,000 men the first day that Oklahoma country was thrown open to settlement, has grown in the first few short years since that time to a population of about 95,000, according to the 1920 census. It is the capital and the largest city in Oklahoma.

The city is the center of a rich agricultural and stock-raising region. Cotton mills, flour mills, box and cracker factories, iron works, soap works, packing houses, oil refineries, and cottonseed mills are some of the important industries. A number of wholesale houses are located here.

This city typifies the youthful vigor which characterizes the entire state. There is no "old" part of town; the streets are wide and clean; the public buildings modern and well designed. Despite the handicaps of soil and climate many of the residence districts have been beautified by carefully tinted settings of shrubbery and vines.

Oklahoma City is the home of the Oklahoma City College and St. Mary's Academy. The State University at Norman is within an hour's ride on the interurban, and the Central Normal School at Edmund even closer.

OLEAN'DER. Its glowing clusters of roselike flowers, rising above long dark leathery lance-shaped leaves, make the oleander one of the handsomest of flowering shrubs. But be careful how you handle it, for the leaves when broken exude a milky juice which, like most other milky plant juices, is poisonous. Children have been badly poisoned by handling this tall evergreen shrub, and it is said that British soldiers in Spain during the Peninsular War died after roasting meat on freshly cut oleander twigs. The common oleander, a native of the Mediterranean region and of tropical and subtropical Asia, is found now in many countries both as a house plant and as an ornamental out-of-door shrub.

The oleander belongs to the dogbane family (*Apocynaceae*). Scientific name of common oleander, *Nerium oleander*. The upper edge of the corolla is fringed in petal-like scales; there are five short stamens, and the anthers are tipped with a hairy bristle. The seeds in the spindle-shaped pods are tufted with silky hairs like thistledown.

SQUEEZING THE OIL FROM BEEF

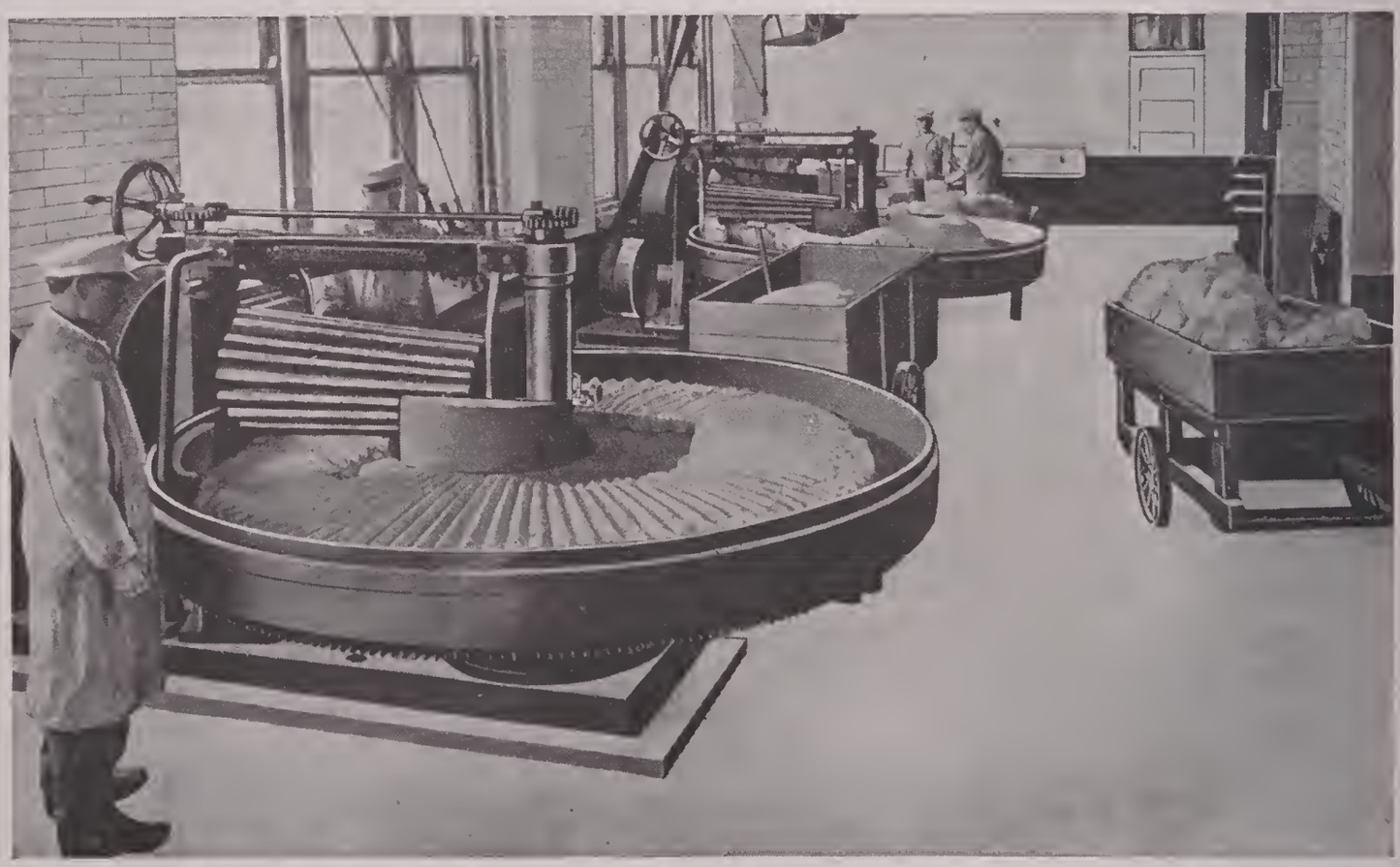
To get the oil for making oleomargarine, huge presses like this squeeze the beef fat. You can see the oil running out of the pan.

OLEOMARGARINE. A prize was offered by the French government at the time of the Franco-Prussian War to anyone who would produce a good substitute for butter. The prize was won by Mége-Mouries, a French chemist, who originated a process for making a product from beef fat called *margarine* or *oleomargarine*. This proved to be a real substitute, for it had the appearance of butter, contained similar amounts of fat and other food elements, and was cheaper than good butter and more wholesome than poor grades. It was a real boon especially to the peasant class who had been obliged to do without sufficient fats or use only cheap and unwholesome butter. Its use spread rapidly in the countries of Europe. In the United States its annual production is now about one-third of the butter production.

There are two types of oleomargarine, the "butter fat" or "animal fat," and the "vegetable fat." The former is made of oleo oil (from beef fat), neutral lard (from the leaf fat of the hog), peanut oil or some other vegetable oil, milk and cream, and salt. The latter, which is often called "nut butter" and marketed under such trade names as "Troco," "Nucoa Nut Margarine," etc., substitutes coconut oil, peanut oil, palm oil, cottonseed oil, or other vegetable oils for the oleo oil and neutral lard. The use of vegetable oils for this purpose is a recent

WHERE OLEOMARGARINE IS MADE BY THE TON

These great vats are filled with neutral fat destined for use in the finished product. The "neutral" is kept here until it is properly seasoned, and then is mixed with milk, cream, and other ingredients. The mixture is churned to produce the "oleo," and in the churning becomes smooth and soft like butter.



Here great corrugated rollers are working over the material that comes from the churn. Round and round the pans go beneath the rollers, slowly squeezing out the buttermilk and surplus moisture, and working salt through and through the oleomargarine. When the rollers have finished the oleomargarine is ready to be tested and packed into bricks and tubs for the market.

For any subject not found in its alphabetical place see information

development, made possible by the discovery of a process for introducing hydrogen into them, thereby raising their melting point.

The beef fat is washed, chilled, run through cutting machines, and then melted at low temperatures. The resulting oil is cooled to a pasty mass and the oleo oil is removed by pressure, flowing into a tank of cold water, where it solidifies into granules. Fresh leaf lard similarly treated yields the "neutral lard." These fats are mixed in varying proportions, sometimes with the addition of vegetable oils or butter, melted, and churned with clarified and pasteurized milk, which has been previously "ripened" by the addition of a "starter." The pasty mass collected from the churn is sprayed with cold water to solidify it, allowed to "season" for a time, and then salted and worked just like butter (*see* Dairying).

There has been much opposition to the use of butter substitutes, but the chief objections have been raised because of the fraudulent sale of such products as butter. Made of pure fats and sold on its merits, oleomargarine is a valuable and wholesome food. It does not have the delicate flavor of butter, and the growth-stimulating element found in butter (*see* Butter) is lacking or reduced in quantity, according to the amount of milk products used in its manufacture. However, oleomargarine has the advantage of keeping better than butter, for it does not turn rancid so readily. To prevent unfair competition with butter, a special tax is levied on oleomargarine which is highest on the product colored to imitate butter, and government inspectors regulate its manufacture and sale. Most producers of oleomargarine take advantage of the lower tax on the uncolored product and include coloring matter with the package so that the buyer may add it later.

There are a number of tests for distinguishing between oleomargarine and pure butter. The boiling test is a simple one which can be applied in any household. Heat a small sample in a tablespoon held over a kerosene lamp or gas jet turned low, and stir with a splinter of wood until it boils briskly. Genuine butter will foam and boil with little noise, while either renovated butter or oleomargarine will boil noisily and sputter like a mixture of hot grease and water.

Olive. The olive is the Methuselah among cultivated trees, for in ancient olive groves there are found giants 20 feet around and 700 to 1,000 years old. The tree does not come into full bearing until it is 30 years old—an age at which most orchard trees are past their useful life—and it exhibits wonderful vitality by continuing to bear throughout its long life.

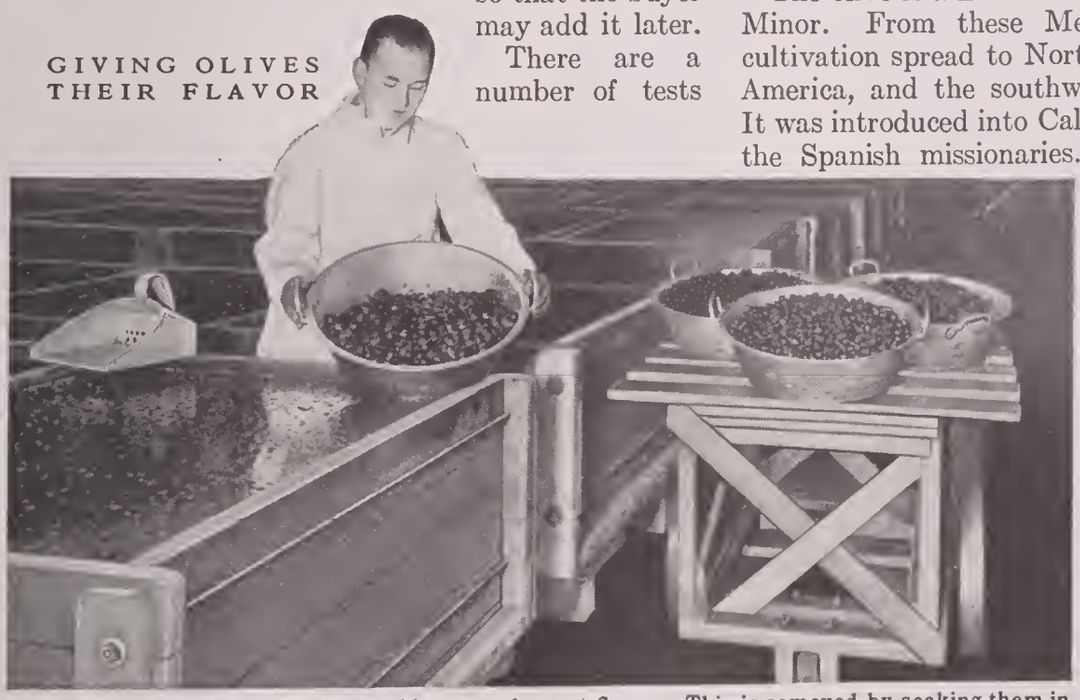
The cultivation of the olive began in prehistoric times, and its products, chief of which is the oil pressed from its fruit, were of great importance to the ancient world. The strength and fruitfulness of the olive tree were proverbial, and the olive branch was a symbol of peace and plenty. In Greece it was sacred to Athena, and a crown of olive leaves was the reward given victors in the Olympic games. Before the discovery of soap, anointing the body with olive oil was extensively practiced by wealthy Greeks and Romans.

The olive tree is one of the fruits mentioned in the Bible, and Palestine still has its famous Mount of Olives. One peculiarity of the olive is that it thrives particularly in soil composed chiefly of volcanic ash. After each destructive eruption of Vesuvius and Etna, the olive groves at the base and even on the sides of the volcanoes have been replanted.

The olive is a native of southern Europe and Asia Minor. From these Mediterranean countries its cultivation spread to North Africa, Australia, South America, and the southwest of the United States. It was introduced into California at an early date by the Spanish missionaries. California is the chief olive-growing state, but parts of Arizona and New Mexico are also suited to its cultivation.

Today as in ancient times the products of the olive are of great value for food and other purposes. In the Mediterranean countries olive oil is used as we use butter and other fats for cooking, and it is highly prized everywhere as a salad oil. The inferior grades are used for lighting and for soap-making. Although the industry in California has developed

GIVING OLIVES THEIR FLAVOR



When first picked, all olives have a bitter, unpleasant flavor. This is removed by soaking them in clear water in large vats. Sometimes, if it is desired to hasten the process, a solution of potash lye is used, but olives treated in this way must later be soaked in clear water, which must be frequently changed. They are then placed in brine, first a weak solution, which is gradually strengthened until the desired flavor is obtained.

rapidly, the United States imports millions of gallons of olive oil and a great quantity of pickled olives, chiefly from France, Spain, and Italy. Dried ripe olives are eaten in Greece, but in most other countries they are pickled, either ripe or green.

The olive contains as high as 60 to 70 per cent of oil, which gives it its food value. In olive-growing communities the people get oil for their own use by crushing the fruit in a press similar to the cider press. For the commercial production large mills are used. The rich yellow high-grade oils are drawn off first. Then water is poured over the compressed pulp and pressure is applied to remove the inferior grades of oil, which may be recognized by their greenish color.

When green olives are picked from the tree they are bitter. To remove the unpleasant flavor they are soaked in lye, and after rinsing are put into a brine solution. Chemical analysis shows little difference in composition between the green and ripe pickled olives.

The wood of the olive tree is very hard and possesses a beautiful grain and color, and it is used for ornamental cabinet work. The tree, which attains a height of 25 feet, is covered with a gray bark; its evergreen leaves are smooth, thick, and grayish-green above and white underneath. Scientific name of the cultivated olive tree, *Olea sativa.*

Olympic games. For more than a thousand years the Olympic Games of the Greeks were held in July of every fourth year in honor of Zeus, the highest of the gods. A traditional list of the victors constructed in later times went back to the games of 776 B.C., and this date was later taken as a convenient basis from which to reckon time, using as units the "olympiad," or four-year period between the celebrations. The games were held in one of the fairest spots in all Greece—the well-wooded valley of Olympia in Elis, through which, in sight of snow-crowned peaks, flows the famous river Alpheus. To adorn this natural sanctuary the greatest artists of the land wrought statues and built temples in a sacred grove dedicated to the Olympian Zeus. Most magnificent of all the shrines was that of the father of gods himself, in which stood a colossal statue of Zeus wrought of ivory and gold by the great sculptor Phidias, and reckoned as one of the Seven Wonders of the World.

Across the sacred grove, after due sacrifice had been made to the gods, the athletes marched to the stadium, where the contests took place. At first the only event was a 200-yard dash. Later this was supplemented by the *pentathlon*, a five-fold match consisting of running, wrestling, leaping, throwing the discus, and hurling the javelin. Other trials of strength, skill, and endurance were later added, including boxing and a chariot race.

The prizes given the victors were simple olive wreaths from the sacred olive-tree which grew behind the temple of Zeus—planted, according to tradition, by Heracles (Hercules), the founder of the games. Thus crowned, the winners marched in glad procession around the sacred grove, while their admirers chanted to the accompaniment of the flute triumphal songs written for the occasion by some great poet. When the victors returned to their native cities they were received with extraordinary honors. Statues

ALL HAIL TO THE WINNER!

In this painting the artist has pictured the finish of the foot race, the last event of the Olympic Games, when these were at their height. When this last race was over, the great crowd, which had already worked itself up to a high pitch of enthusiasm, jumped to its feet and cheered wildly, the trumpeters blew great blasts on their instruments, and the air was filled with waving olive branches. For this event the distance was usually twice the full length of the stadium.

were erected to them, they occupied the places of honor on public occasions, often they were exempted from taxes, and in some cities they lived thenceforth at the public expense.

These contests also had a religious significance, for the Greeks believed that the body of man has a glory as well as his spirit, and that men could best honor Zeus by developing mind and body in harmony. The Olympic Games exerted a profound and ennobling influence on the life of the Greeks. A sacred truce was proclaimed before the opening of the festival, and if any of the cities were at war, fighting ceased during the celebration. Men from all parts of the Greek world came together on these occasions, and thus friendship and unity were fostered. The Roman emperor Theodosius abolished the games in 394 A.D. (For the modern Olympic Games *see* Athletics.)

OMAHA, NEB. The "Gate City of the West," as Nebraska's metropolis has been called, stands on a height overlooking the Missouri River and commands the entrance to a vast inland empire stretching 1,500 miles westward. Here begins the great overland route first used by the Indians, and then by the stream of immigrants who traveled to Oregon and California by stage coach, pony express, and ox team. Today Omaha is one of the chief railroad centers of the United States and the half-way station on the New York-San Francisco aerial mail. Through it pass the Lincoln Highway, the great automobile route across the continent, and other great roads.

No city of its size conducts a greater volume of business. Its manufactures, particularly those based on agriculture, have had a remarkable growth. It leads the United States in the production of creamery butter and has one of the largest macaroni factories in the country. It is the second corn and live stock market in the world.

Although Nebraska itself yields no metals, one of the country's largest refining smelters is located in Omaha; here the great trunk lines bring in from the western states their daily toll of ores.

Fine public buildings, libraries, and art galleries, and a score of parks connected by a boulevard system 35 miles long are among the city's many attractions. Omaha is the seat of the military headquarters of the Department of the Missouri, and at Fort Omaha, within the city limits, is located the chief balloon school of the United States.

The city is named from the Omaha tribe of Indians, a branch of the Dakotas. Although a trading station had previously been established, it was not until 1854 that a treaty was concluded with the Indians whereby the land was surrendered to the white men. Omaha then became the capital of Nebraska Territory, but in 1867 after Nebraska became a state the capital was removed to Lincoln. Omaha was one of the first large cities to adopt the commission form of government. Population, about 195,000.

ONION. From the fragrant Easter lily to the humble onion with its pungent odor may seem a far cry; but the gap is not so great as it seems, for both belong to the large lily family. The characteristic odor and flavor of the onion come from a sulphurous oil which is driven off by boiling.

The mildest and biggest of the onions are those of the white Spanish variety, which often weigh a pound or more. They grow in California and the Southern states and in the Mediterranean countries. The Bermuda onion, which is also grown in the United States, is nearly as large and sweet as the Spanish. The potato onion is a form that has several small irregular bulbs instead of a single bulb.

Onions have been grown for their edible bulbous roots from time immemorial. Their original home is supposed to have been in central Asia. They belong to the same genus, *Allium*, as the milder leek, and the more pungent garlic, both of which are extensively cultivated in Europe. Chives are smaller members of the same genus; they are grown as an ornamental border for gardens and also for their leaves, which are used for seasoning. Shallots have a flavor somewhat milder than garlic.

WHAT A CHANGE SINCE FRONTIER DAYS!

This array of great buildings in Omaha's principal business district is a symbol of the energy which since 1854 has turned a trading post and frontier settlement into a thriving city. Today Omaha covers 34 square miles, has over 200 miles of paved streets, and 1000 acres of public parks. It still serves the Far West but with a mighty system of railroads, instead of prairie schooners and the pony express.

The INDUSTRIAL HEART *of the* CANADIAN DOMINION

Extent.—Greatest length east to west, about 1,000 miles; north to south, 885 miles. Area, 407,270 square miles, including about 41,380 square miles of water surface. Population, about 2,600,000.

Physical Features.—Great Lakes (Superior, Huron, Erie, Ontario) and St. Lawrence on the southern boundary; James Bay (an arm of Hudson Bay) on the north. Lakes: Nipissing, Nipigon, Lake of the Woods, and numerous lesser lakes. Principal rivers: Ottawa (tributary to the St. Lawrence), Albany, Moose, Attawapiskat, and Severn (flowing into Hudson Bay).

Products.—Hay, oats, wheat, corn, flax, apples, grapes, and small fruit; cattle, sheep, hogs, and horses; butter and cheese; nickel, silver, copper, gold, iron, petroleum, and natural gas; lumber and timber products; iron and steel products, machinery, electrical apparatus, paper and pulp, textiles and clothing, meat products, flour and meal, leather goods and shoes.

Chief Cities.—Toronto (capital, about 500,000), Hamilton (115,000), Ottawa (Dominion capital, 100,000), London (60,000), Brantford, Kingston, Kitchener, Peterborough, Port Arthur.

ONTARIO, CANADA. The province of Ontario may well be regarded as the center of Canada geographically and politically. Lying as it does between the provinces of Quebec and Manitoba, it connects the old part of Canada with the great new prairie regions of the West, and at Ottawa, an Ontario city and the capital of Canada, centers the political life of the Dominion.

In wealth and population Ontario stands first among the provinces, and it is second in area, with more than 407,000 square miles. In it live nearly one-third of the Canadian people. But if the entire population of Canada were scattered evenly over the province they would not be crowded, for Ontario is almost as large as France and Germany combined, and the distance from the extreme eastern part to the extreme western is 1,000 miles—about as far as from New Jersey to Kansas, while from north to south it stretches 885 miles.

The greater part of the inhabitants live in the southern part on the tongue of land between Lake Huron and lakes Erie and Ontario. Here the climate is delightfully mild, tempered by the influence of the Great Lakes. This is the garden of Canada, where great quantities of grapes, pears, peaches, plums, and apples are grown. Here also the farmers raise hay, oats, wheat, barley, corn, and flax, but they have found that it is more profitable to feed their hay and grain to cattle and swine than to sell it, and so the region has become famous for its dairy and meat products. This district makes one-third as much cheese as all the United States. Most of this tremendous output is exported.

The region is also abundantly supplied with waterpower, the chief source being Niagara Falls, the rapids of the St. Lawrence, and the falls of the Ottawa River and its tributaries. This cheap power with the abundance of raw materials and Ontario's ample transportation facilities by rail and water have made it the chief manufacturing province of the Dominion. Almost every article used in daily life is made there, but most of the manufactures are used in the Dominion. The southern portion is dotted with towns and cities, the most important being Toronto, the capital of the province, Ottawa, London, Kingston, and Hamilton (*see* separate articles on these cities). Numerous railways, both steam and electric, connect these places and form a network over the region. A splendid system of canals, chief of which are the Sault Sainte Marie and the Welland and the upper St. Lawrence, gives additional means of transportation in summer.

In the part of Ontario north of lakes Superior and Huron towns and cities are fewer. Until recently people thought that this land was useful only to the fur-trader and the lumberman, but now it has been discovered that the hardy grains can be raised there, despite the long cold winter, and so this district is being settled by farmers.

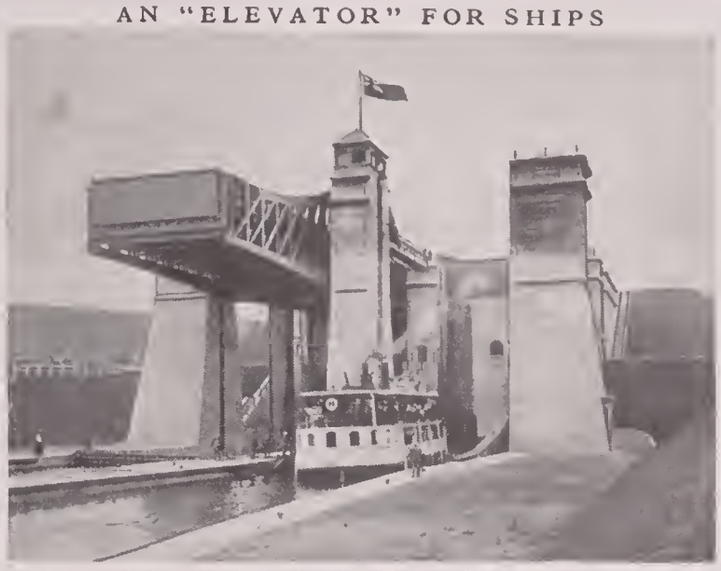
But a more valuable source of wealth in this northern region has been found recently in the rich mineral deposits from which come nearly half of all Canada's mineral production. In the Sudbury district north of Lake Huron three-fourths of the nickel supply of the world is mined. From the Cobalt

region come great quantities of silver, making Canada one of the leading silver-producing countries. In the south are considerable wells of petroleum and natural gas. Copper, iron, zinc, gold—in fact, almost every useful mineral except coal—are all found in Ontario.

North of the "Height of Land," which divides the water systems of Hudson Bay and the St. Lawrence, towns disappear entirely, and great forest areas extend over most of the northern districts. These cover more than one-half of the surface of Ontario and are the source of one of the province's chief industries. Here in winter the lumberer cuts the spruce from which paper-pulp is made, the pine for lumber, and the white cedar for shingles and laths. Through the great trackless forests roams the fur-trader, seeking the otter, the beaver, and the marten. The hundreds of beautiful lakes and rushing streams make the southern watershed a favorite region with campers and sportsmen.

Until 1783 the fur-trader and the Indian had practically entire possession of the region now included in Ontario. But after the close of the American Revolution many British Loyalists who suffered persecution as "Tories" in the United States settled in Ontario because they wished to continue to live under the British flag. These were the real founders of the province. In 1791 England organized the territory as the Province of Upper Canada. In 1841 it was reunited with Lower Canada or Quebec, after the rebellion headed by Mackenzie in 1837. In 1867, after a period of bitter controversy and deadlock, it was again set off as a separate province, under its present name, and entered the newly formed Dominion of Canada. Population, about 2,600,000. (*See also* Laurentian Plateau.)

AN "ELEVATOR" FOR SHIPS



This hydraulic lift lock in the Trent Canal at Peterborough, Ontario, is the largest of its kind in the world. It can raise ships of 800 tons through a lift of 65 feet. The lock consists of two great tanks which move up and down between the supporting piers. When that ship has entered and been closed within the lower tank, the upper one will be filled with water enough to counterbalance the weight of the ship and the water below. Then by a system of great plungers the lower tank will be forced up as the upper tank descends.

Ontario, Lake. The smallest, the easternmost, and the nearest sea-level of the five Great Lakes, Lake Ontario is 190 miles long, with an area of 7,260 square miles. Its surface lies 247 feet above and its bottom 491 feet below sea-level. Its greatest depth is 738 feet. At the beginning of the 18th century Lake Ontario had more traffic than all the other lakes put together. It was there that the first American lake vessel was built for trading in 1789, and the first steamboat on the lakes appeared here in 1817.

Lake Ontario is fed principally by the Niagara River, through which the waters of Lake Erie rush in a terrific tumble of 326 feet in 36 miles. Since 1829 vessels from Lake Erie have been able to go around Niagara Falls, through the Welland Canal. But the traffic remained small compared with that of the other lakes, partly because the canal was inadequate. Until after the World War it admitted vessels of only 14-feet draft. (*See* Great Lakes.)

GETTING RID OF THE WASTE AFTER EXTRACTING NICKEL

A train-load of red-hot molten slag is being dumped on this slag heap at Sudbury, Ontario. This is probably the most spectacular part of the whole process of producing nickel, presenting the appearance of a series of small volcanoes pouring out their glowing lava.

Opera. An opera is a drama set to music. The "libretto"—that is, the story—is sung in the form of solos (one actor singing alone), duets, trios, quartets, quintets, or sextets, which two, three, four, five or six actors sing together. There are also choruses in which large numbers of singers take part.

The first opera, 'Eurydice', given in the year 1600, was the work of a group of cultivated musicians of Florence, Italy. They wished to revive the lost art of declamation to music, as practiced by the ancient Greeks. They took the ancient myth of Orpheus and Eurydice and arranged it so that the various characters sang the story, accompanied by a small orchestra. The opera had an enormous success and became the model for other music-dramas. The leading musicians of Europe began to experiment with the new idea, and before long had not only invented many new song-forms but had also discovered new ways of using instruments and new combinations of tones into new chords. So the old cramped rules governing musical composition were rapidly abandoned.

As the opera became popular in the different countries of Europe, the musicians of each began to compose in a style that expressed the peculiarities of their own people. Thus grew up what came to be known as Italian opera, German opera, French opera, and English opera. The composers of the Italian school made vocal music much more important than the instrumental music, and even than the action of the drama itself; for instance, a character, in an instant of great danger, might be made to delay the action in order to sing a long and elaborate solo about his impending danger. In the German school, as developed by Richard Wagner, whom many regard as the greatest opera composer of all time, quite the contrary was true. The dramatic interest of the story was the important feature of the opera and all the possibilities of the instruments and of the singers were used to give expression to the story. French grand opera put especial emphasis on pomp and pageantry and the ballet, so much so that these incidental features in many cases over-balance the development of the story. In the 20th century, however, such French composers as Debussy and his followers have given the opera, not only in France but in all Europe, the same tendency to "impressionism" that has marked most recent work in other musical forms.

TWENTY FAMOUS OPERAS

In the first column is given the name of the opera, with the date of its first performance; in the second, the name of the composer.

Aïda (1871)	*Verdi*
Carmen (1875)	*Bizet*
Cavalleria Rusticana (1890)	*Mascagni*
Don Giovanni (1787)	*Mozart*
Faust (1859)	*Gounod*
Hänsel und Gretel (1893)	*Humperdinck*
Huguenots, The (1836)	*Meyerbeer*
Il Trovatore (1853)	*Verdi*
La Bohème (1896)	*Puccini*
Lohengrin (1848)	*Wagner*
Madame Butterfly (1894)	*Puccini*
Marriage of Figaro (1789)	*Mozart*
Meistersinger (1866)	*Wagner*
Mikado (1885)	*Sullivan*
Pagliacci (1892)	*Leoncavallo*
Pelléas et Mélisande (1902)	*Debussy*
Robin Hood (1900)	*De Koven*
Salome (1905)	*R. Strauss*
Tales of Hoffman (1881)	*Offenbach*
Tannhäuser (1845)	*Wagner*

Side by side with the development of the grand opera proper, a lighter form of music drama has grown up, known in Italy as *opera buffé* and in France as *opera comique*. In this type the stiff conventionalities of the old classical opera are replaced by an effort to represent more closely scenes of actual everyday life, and the stilted set "recitative" and "aria" are largely replaced by swiftly moving dialogue. A still further development along this line is represented by the *opera bouffe* or "comic opera," in which part of the dialogue is spoken instead of sung and liveliness and humorousness are the chief aims. The work of the gifted Englishmen Gilbert and Sullivan has made this the most popular of all forms of music drama. The "musical comedy" of today, which sprang from this light opera form, has for the most part become a mere series of farcical and spectacular scenes with songs and incidental music interspersed and can claim little relationship with genuine opera.

The expense of producing grand opera is so great, especially in America, that only the largest and most wealthy cities can maintain a grand opera company. However, favorite opera selections are often heard from the concert platform, and are also reproduced with great fidelity by many phonograph records of the present day. Large companies also visit smaller cities after their home seasons.

Opium. Late in February the broad flat fields along the river Ganges in India are white, as white as the snowy crests of the Himalayas, far to the north, to which they seem almost to reach; for this is the blossoming time of the poppy (*Papaver somniferum*), from which opium is made.

Before the monsoon season of rains begins—for the poppy cannot stand wet weather—countless half-naked natives squat all day in these fields making little incisions in the pale-green capsule-like seed pods now fully developed. From two to six different times, at intervals of two to three days, the field must be gone over again, plant by plant, to gather the pinkish sticky juice which exudes from these cuts.

For four weeks the gluey mass is exposed on flat dishes to the burning rays of India's summer sun, until evaporation makes it thick enough to be taken to the government factory. There it is weighed, tested for adulteration and dirt, and thrown into deep wooden vats in which black scrawny creatures tramp back and forth, kneading it to a uniform consistency.

For any subject not found in its alphabetical place see information

Next it goes to a man who molds of it a ball fitting snugly within a brass cup lined first with poppy petals. When a perfect hemisphere rises above the edge of the cup, the enfolding leafy case is brought up over the ball, and one large leaf laid over the top, closing it air-tight like a seal.

Quite moist still, these balls must be "sunned" again and turned constantly until they are absolutely dry and quite solid, about October 1. Then they are packed in chests and set away in a dry warehouse for a long time. Some day they travel away from India in the holds of great ships, usually on a long voyage round the Malay Peninsula to the ports of China.

The trade in opium and its derivatives, laudanum, morphine, and heroin, is one of the great international curses. China is degraded by its extensive use and has struggled for centuries to control its sale. In 1839 her efforts were so drastic that they involved her in the so-called Opium War (1840–42) with Great Britain. Although the cultivation of the poppy and the smoking of opium has been absolutely forbidden in China by a series of decrees (1906–17), there are places, on river-boats and in obscure corners of crowded cities, where the almost violent heavy fumes and sickening odor of burning opium can still be ferreted out. The strong governments of the East, the British and Japanese, have too often looked on opium as a source of income and closed their eyes to the effect of the drug on the users. More serious is the fact that we need go no farther than the United States to find many victims of this frightful habit which wrecks its unhappy slaves, mentally, morally, and physically. This has led to Federal legislation restricting the trade to medicinal uses only.

THE SLEEP-BRINGING POPPY

This is the white or opium poppy, from which opium is obtained.

Though the improper use of opium is such a curse, the drugs derived from it, called *opiates*, are of immense value in the hands of a careful physician. They are administered to relieve pain and make it possible for patients who are gravely ill to obtain much-needed sleep. While India collects a far larger yield than other countries, opium is also manufactured in Persia, Turkey, Macedonia, and Bulgaria.

OPOS'SUM. You might not guess that this little native of the southern United States is a cousin of the Australian kangaroo. He doesn't look much more like a kangaroo than a cow looks like a camel, but both kangaroos and opossums belong to the curious order of marsupials, or pouched animals.

The opossum is about 20 inches long and has a body much like the body of the raccoon or little tree-bear. He too lives in trees. Little boys—especially little colored boys—down South often catch him when he is a baby and bring him up for a pet. And he is the cunningest little fellow, with a famous trick.

Did you ever "play 'possum"? You shut your eyes and pretend you're asleep, for a joke. The opossum does this in earnest to make his enemy think that he is dead. He fools his pursuers sometimes by rolling up into a limp ball and lying still. But a pair of bright eyes are watching out of the fur, and when the enemy is off guard the 'possum unrolls and slips away.

The opossum doesn't jump like the kangaroo. All four of his legs are the same length, with five-clawed toes for climbing. He doesn't walk very well and he takes to a tree as quickly as possible. His dingy white or gray fur is tipped with brown all over, so it is not easy to see him in a tree. He has a long scaly tail like a rat's, but he can use it as a monkey uses his tail for climbing and swinging. He has the sharp pointed face of a big rat, the naked ears of a bat, the five-clawed feet of a little bear, and the pouch of the kangaroo; so altogether he is a curiosity. He makes his nest in the hollow of a tree like a bear, but he doesn't leave the babies at home. Mamma 'Possum carries them in the pouch on her abdomen when they are small. There are often as many as a dozen or more of them, and they are only half an inch long when they are born.

When 'possum babies are about as big as mice and are old enough to come out of the bag, they like to ride on their parents' backs. There are so many of them that part of the family climbs on the father's back and part on the mother's. There they sit in a row, clinging fast with their claws to the fur and with their little tails wrapped tight around the parent's tail, held high over his or her back.

Opossums are rather sluggish, stupid creatures. They are night prowlers. On still, bright, moonlight nights whole 'possum families are out in the fields, woods, and swamps, hunting for berries, nuts, grain, and farm and garden vegetables. But they eat the destructive cotton-rat and this helps to pay for the good food they consume. They also eat insects, young squirrels, and birds' eggs. They love best of all the sweet frost-wrinkled persimmon.

Opossums are found in most parts of the United States, except the extreme north, and all over South America. There are over 20 species ranging in size from that of a mouse to that of a cat. Scientific name of common opossum, *Didelphis virginiana.*

OPTIMISM

THE hope of the earth is the optimist looking forward and believing all is well. There are pessimists everywhere, despairing of humanity, believing in the doom of all things; but the faith that is based on reason refuses to be mocked and told that life is an empty dream. The optimist believes, with Longfellow, that "life is real, life is earnest."

The difference between the optimist and the pessimist, between faith and cynicism, is largely the difference between knowledge and ignorance. We may be swayed by sentiment into feeling that evil holds the world, but all the history of the past replies that good will come. If we are to be optimists let us base our faith on the solid ground of fact and reason; let us know *why* we believe. And what is the foundation of sane optimism in a world like this? It is founded in history, which shows us that all the ages have led men on to higher things and greater powers, in spite of dark periods of evil. The world of today is beyond all the dreams of yesterday; the world of tomorrow will be greater than we can think.

The Immeasurable Future

The mind that understands the past will shrink from no vision of the future that imagination can conceive. A few thousand years have opened up the entire field of human knowledge; a few hundred years have "made us masters where we were slaves." What, then, is impossible in millions of years? Who knows that the ages in which this book appears will not be like a moral Stone Age before the world is 20 lifetimes older?

The mysterious power of man, the mighty processes of chemistry, the strange promptings of the soul, the throbbing in ethereal space—who shall set a limit to illimitable things like these? Man does not even know whether he is alone in the universe. He has no reason to be surprised if tomorrow the mighty atom should suddenly release its power and banish poverty and weariness for human kind. He need not be surprised at anything that radium does, or at any new powers discovered in the ether. He will certainly ring up the other side of the world as readily as he rings up his neighbor, and only dull folk will be surprised if a dozen things as startling as that happen in the next decade.

A man in a laboratory may do more for his race in a day than all the parliaments of Europe in a generation. A man in a scientific workshop may give us means of investigation inconceivable to us now. Who, before the microscope was invented, could have dreamed of the wonder in the tip of a root? Who, before the telescope came to peer into infinity, could have guessed the unfathomable wonder of the heavens? Who could have dreamed, even when the microscope came at last, that this scientific toy would save more lives in one generation than all our laws? Man can change the lives of animals and plants, raising new kinds of either. He can enormously modify or develop the two great branches of life and its kingdoms. Who knows that the future may not hold within itself the secret of some intellectual advance of man corresponding with his advance in other realms? How many years will it be before the American man of science ranks as much above an Edison as an Edison does above a charlatan? We can produce wheat free from rust; why not *men* free from disease? One thing is certain: the discoveries of new powers and their applications will be immeasurably beyond all human experience, and the child born in the World War will live on into a world now beyond imagination.

It is not the scientific but the unscientific mind, says Darwin, that sets limits to the possibilities of knowledge; and it is ignorance, and not wisdom, that talks of Evolution as if it had stopped.

The Past a Prophecy of the Time to Come

The promise of what man yet will do is in the things that man has done, but beyond all possible comparison will be the wonder of the things to come. What is the stopping of war compared with the things that man has done? It is child's play. The wildest visions of the dreamer are not wilder than the visions of Marconi would have been when he was born. The wildest vision of the sea without a battleship, or a state without a gun, is not wilder than the vision of the world we live in would have been to Aristotle and Shakespeare and Newton. We know there was a world they did not dream of, for we live in it; what right has any man to say that there is not another world, and others after that? The only

environment our first ancestors knew may have been water, until some great explorer, some microscopical Columbus, found the world of air. It was a world beyond all their imagining, but there was still another world, found by some Newton-like *amoeba*, who felt the warmth of the sun on some sensitive spot, and discovered light and heat. Who are we, with new worlds opening round us year by year, to say that life has no more chambers to unlock!

We may be disappointed that the world has not reached perfection after a hundred centuries of history and 19 centuries of Christianity. But this world will never reach perfection, for perfection changes with every age that comes and every age that goes. The vision of the fathers is the realization of the children; but the children's visions only the children's children see. "To travel hopefully," says Robert Louis Stevenson, "is a better thing than to arrive." *We* must travel hopefully. We must not be discouraged because Life is a journey without an end; we must agree rather with the wise German who loved truth and said that if God were to offer him the truth in one hand and the search for truth in the other, he would take the search for truth.

A Long Apprenticeship but It Paid!

For a thousand centuries the human race moved slowly; for a hundred centuries men have built up cities and filled them with beautiful things; but the great quickening-up of the world is hardly one century old. It is as if man had served a long apprenticeship and suddenly awakened to his powers. Man has had a million years at least upon the earth, but in civilization only a few hundred lifetimes. He is only a step or two on his great march to the conquest of the earth, but already he stands at the gates of a new dominion. He has found new powers over the forces that he knows, and is peeping on tiptoe through the keyhole of an unknown world.

It is nothing that a thing should seem incredible; it is the constant incredibility of the world that staggers thinking men. In the *amoeba* days who could have guessed that the gigantic lizard-like *dinosaur* would come? In the *dinosaur* days who could have guessed that man would come? In the cave days of man who could have guessed that Shakespeare would come? And who, in Shakespeare's day, except perhaps some poor wild Roger Bacon—the 13th century friar—could have conceived the Wireless Age?

Has the movement of the world been good or ill? Only an idiot doubts. The world does not need defense or vindication. Has Human Evolution been long or slow? It has been almost like a lightning flash compared with Nature's Evolution. Side by side with the unknown millions of years of preparation, civilized mankind is but an hour or two old. Through how many millions of years animal instincts were weaving themselves into the life of man we do not know; we do know that but a few thousand years have gone to crush them out of him. We know that in a few thousand years the savage creature of the wilds has changed into a Milton or a Florence Nightingale. We know that in this same few thousand years the brother of the wolf has become the faithful guardian of the child. Those who know all these things will not refuse to believe that in a few more years we may see such miracles again.

Science Will Set All Men Free

In the new age that is coming science will give us power, and power will give us leisure. Industrial slavery will go the way of physical slavery, and men will give their reasonable labor, and not their bodies and their souls, for bread. In olden days it took 400,000 men to do the work that one train will do. We are beginning to use the power of the sun and the running rivers, and Niagara has power enough at the Falls to do the work of all America. If all the power of Niagara could be harnessed it would give every human being in America a power-slave of his own. It is said that in the great days of Athens every freeman had five slaves who did his bidding; and it is reckoned that in this country now, if we take the power of coal alone, every family has the equivalent of 20 slaves to do its bidding.

Forever great events are in the making; never a day but some seed is sown that will bear unexpected fruit. This seed of great events—how ever wonderful it is! The Bavarian monk Mendel, growing peas in his monastery garden—who could have seen that he was discovering the laws of heredity and forging a weapon to drive back insanity and build up a stronger race? Dr. Ronald Ross in India, examining mosquitoes until he fell asleep—what daring prophet could have seen the Panama Canal in that? An old man bending for hours over a flower on his English hilltop—who that saw him could have dreamed of the glorious conception of the universe that Darwin was building up for mankind? Pasteur poring over his test tubes and his microscope—who knew that the beginning of the end of disease was there?

There is no limit to the promise of the future. We do not produce Shakespeares and Miltons, but we do produce Edisons and Pasteurs and Listers; and there have been among us in our time men whose names will endure when some of the stars in the sky have ceased to shine.

Orange. The orange, carrying its golden beauty and fine fragrance and flavor unchanged around the world, is commercially the most important of the fresh fruits. The apple, it is true, is the long established king of the temperate zone markets, but the orange, grown in all tropical and semi-tropical countries, is offered for sale from the Equator northward to the farthest limits of civilization. The commercial value of the grape is greater than the orange, but the grape rules not as a fresh fruit but through its products—dried as raisins and currants, and manufactured as wine, grape juice, and jelly.

The wild orange was early cultivated and has been carried westward with the march of civilization, each new era opened developing greater importance. Originally a native of eastern Asia, it became a valuable crop in Asia Minor and the Mediterranean regions, establishing itself in the sunny mild climate of Italy, Spain, and southern France. The Spaniards brought the orange to the West Indies, Brazil, and Florida, and the Franciscan fathers planted it in California. Early in the 19th century orange groves were planted in Florida, and in 1894, 6,000,000 boxes were sent to market. Then came a freeze in December and another in February which ruined or badly damaged all the orchards north of the middle of the state and killed those of Louisiana. The Florida groves quickly recovered and today the Indian River orange is among the choicest on the market.

THE BRIDE'S FAVORITE FLOWER

The white waxlike orange blossoms are of extraordinary fragrance. So powerful is the odor from these lovely flowers that an orange grove can be detected half a mile away.

The development of orange culture on a large scale in California came as an indirect effect of this check to Southern production. Today California could fill a train of box cars stretching from New York to Boston and six miles farther out into the Boston harbor with the golden crop of one season. In the United States the demand for oranges is very large, and California supplies 80 per cent of it. Even England is using an ever-increasing quantity of California oranges, and new areas of culture are developing in the irrigated regions of Arizona.

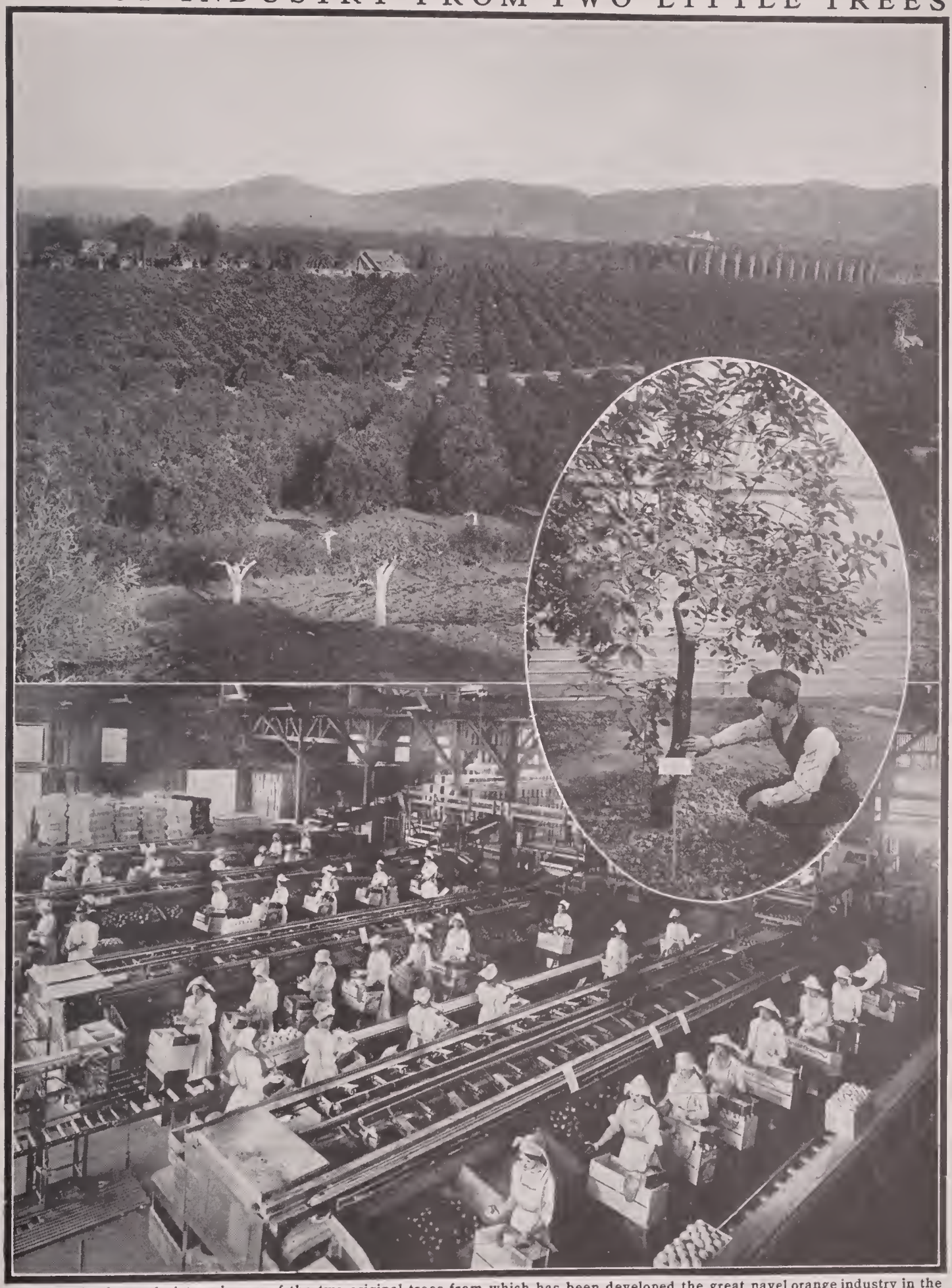
The great orange of commerce is the seedless, fine-flavored Washington navel, which has a funny little wrinkled orange no bigger than an olive tucked into the blossom end. This was the first seedless orange ever marketed. In 1872, a United States consul to Brazil discovered that in Bahia, Brazil, a few orange trees bearing seedless fruit were growing, and he forwarded some shoots of this seedless variety to the Department of Agriculture at Washington, which sent them to an orange grower in California. Two of the shoots lived, and bore seedless fruit of much finer quality than the original Bahia variety. From these two trees, which are still alive, has come the great navel orange industry. One of the chief merits of the American navel is that it can, unlike the Bahia variety, be picked ripe and kept for months, and sent great distances without deterioration.

Orange trees begin to bear when they are about six years old. The best oranges are produced by budding desired varieties on seedlings (trees raised from seeds) of hardy stock. The trees bear more or less continuously, and flowers and fruits in all stages of development can be found on the same tree at almost every season throughout the year. Most of the fruit, however, becomes ripe at one time, and the California crop is harvested in time for the Christmas trade.

An orange grove is so fragrant that you can smell it nearly a half-mile away, and the birds and bees come to it by the thousands. The golden fruit and the white blossoms — the bride's favorite flower—and the dark polished leaves are very beautiful. The trees are planted in regular rows and stand about 25 or 30 feet apart. They require regular pruning, and must be sprayed and fumigated often to destroy the various pests that feed upon them. Ladybugs eat the scale insects, one of the most persistent pests, and are a great help to the growers in their fight. In the largest orange-growing districts of California, irrigation is necessary. Weather conditions must be noted, and if there is any danger of frost everything must be in readiness to light fires throughout the groves. In many big orchards a system of alarm bells connected with the thermometer arouses the sleeping workmen when the mercury reaches the danger point. The fires are built in small wire baskets or pots of crude petroleum, producing a dense warm smoke blanket which keeps the temperature above the freezing point.

But the battle is not over when the crop is ready to harvest. Every precaution against injury to the fruit is taken. The oranges are cut from the bough with scissors and only very short stems are left, so they will not injure their neighbors. The pickers wear canvas gloves to keep their nails from scratching the skin, for the least scratch may open the way for the germs of decay. At the packing house the

A VAST INDUSTRY FROM TWO LITTLE TREES



The tree in the oval picture is one of the two original trees from which has been developed the great navel orange industry in the United States. At the bottom is a shipping station, where the oranges are sorted and carefully wrapped in tissue paper before they are packed into cases. At the top is a typical California orange grove.

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oranges are carefully sorted and graded, wrapped in tissue paper stamped with the name of the firm, and packed in boxes close enough so they cannot move. A certain number of oranges of each grade fill a box, about 96 of the largest grade and about 200 of the smallest. Those which are too small or imperfect are thrown aside.

Tangerines or mandarin oranges are small and fragrant, with loose skin easily separated from the pulp and the sections of the pulp easily separated from one another.

Kumquats are a fruit related to the orange. They are an inch or so long with a thick skin and not much pulp. They are eaten skins and all, and are made into a delicious conserve. The bitter orange, an Arabian variety brought into Spain by the Moors and cultivated mostly around Seville, supplies most of the marmalade of commerce.

Scientific name of sweet orange, parent of most cultivated varieties, *Citrus sinensis*. The bergamot orange, *Citrus bergamia*, supplies bergamot oil, so largely used in the manufacture of eau-de-cologne and other perfumes. Scientific name of tangerine, *Citrus deliciosa*. It is a small tree with very dense foliage and the fruit has seeds of a greenish color.

A YOUNG "MAN OF THE WOODS"

In general appearance the Orang-utan is not as manlike as the gorilla, but the form of his head, particularly in the young ones, is more like that of man than either the Gorilla's or the Chimpanzee's.

ORANGE FREE STATE. A British colony in South Africa, lying between the Orange River and its tributary the Vaal, one of the first members of the Union of South Africa. Until its conquest by the British in the Boer War (1899–1902), it was an independent Boer republic, first settled in 1836. For the most part it is a prairie country, affording excellent pasturage in the summer. The chief industry is the raising of cattle, horses, sheep, goats, ostriches, etc. There are valuable diamond mines and some coal. The climate is heathful and agreeable. Bloemfontein (population, about 27,000) is the capital and largest town. Population of the colony, about 550,000, of whom 360,000 are natives.

ORANG-UTAN. The name of this member of the ape family, found in the swampy forests of Borneo and Sumatra, comes from the Malay language and signifies "man of the woods." It is well named, for like the chimpanzee and the gorilla, it approaches closely to man in appearance and structure. A full-grown male occasionally reaches a height of four and a half feet, but the outstretched arms cover more than seven feet. The body is bulky and covered with long, reddish-brown hair. The legs are short, but the arms are so long as to reach the ankles when the animal is erect, and in walking the knuckles are placed on the ground. Orang-utans, however, are awkward on the ground and prefer the trees, where they can travel at the rate of five or six miles an hour, without special effort, by swinging along on the branches, which they grasp mainly with their hands. They feed on fruits and succulent shoots, being strictly vegetarian in their diet. They get most of their food on the trees, but go to the ground for water. They live in pairs. As a rule they are peaceable, but when disturbed they are fierce fighters. They retire to rest at sundown in nests of broken boughs 20 or 30 feet above ground. In captivity they are teachable and the changing expression of the face makes them most interesting, though they are not so active and intelligent as the chimpanzee. Scientific name, *Simia satyrus*.

ORCHESTRA. When we watch a brass band, we see men playing horns and drums. When we look at a military band we see the same horn and drum groups, and with them a group of players using flutes and clarinets and other wood-wind instruments. When we listen to an orchestra we find, besides all these, still another and larger group playing stringed instruments.

This, then, is the difference between an orchestra and a band—that when we listen to an orchestra we really hear four "bands" in one! There is the *string* "band" made up of various members of the violin family, the *wood-wind* "band" made of all the wind instruments that are made of wood; the *brass* "band," with its various kinds of "horns"; and the noisy group of big and little drums, and all the other queer *percussion* instruments that are struck or beaten. All large orchestras also have one or more harps.

The "strings" form the foundation of the modern orchestra. They are capable of the greatest variety of expression in giving voice to the depths and heights of human emotion. The violins sing the soprano; the second violins the alto, the violas the tenor, the violoncellos (or "cellos") the baritone, and the double-basses (or bass viols) the bass (*see* Violin).

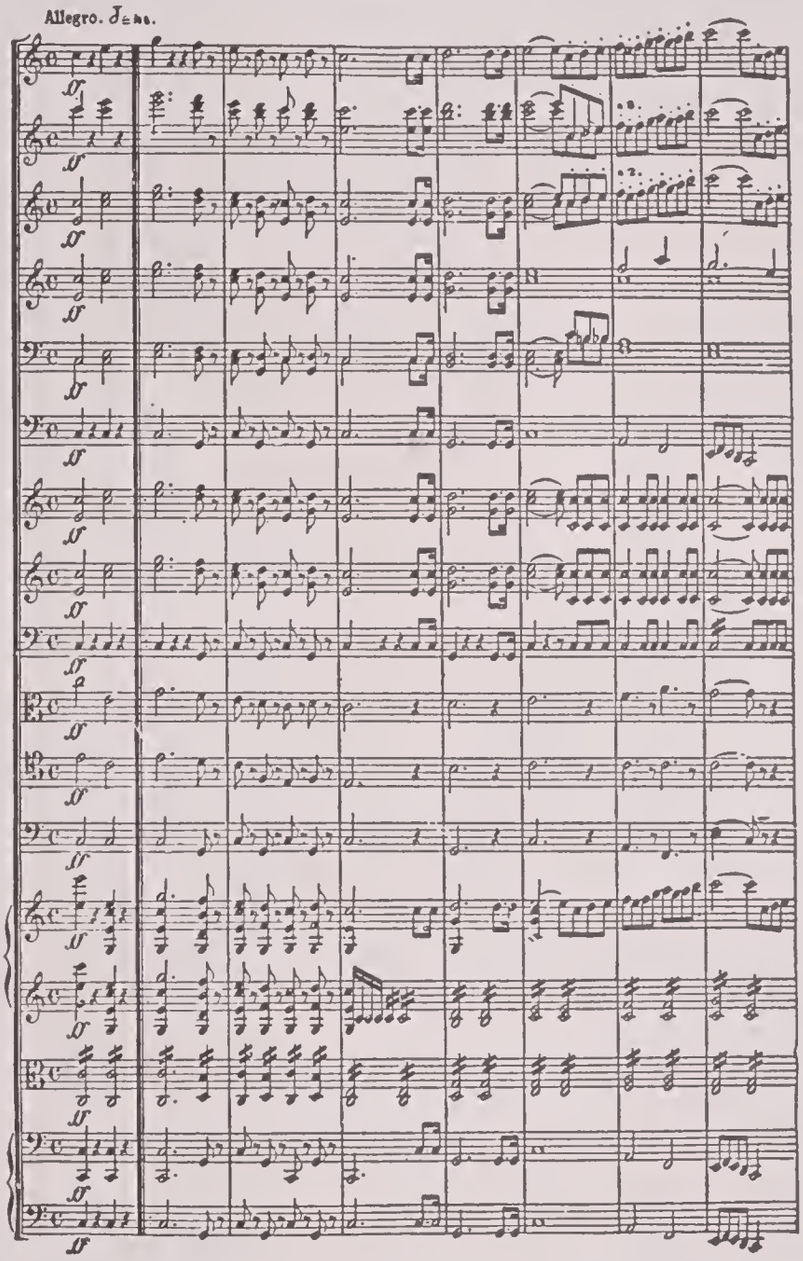
Next in importance is the wood-wind group, which is divided into three families. The first family consists of the flute, which with its clear sweet liquid

notes is the most agile and flexible of the woods; and the piccolo, a shriller flute which has been called "the imp of the orchestra." The second includes the oboe, with its plaintive pastoral tone, and the deeper English horn and bassoon, which may be regarded as alto and bass oboes. The third comprises the clarinets, which are known by their full rich mellow tones. There are usually three of these of different pitch. Oboes and clarinets, as distinguished from the flute family, are reed instruments.

The "brasses" consist of the French horn, which is the old hunting horn adapted to orchestral purposes; the trumpet, with its full round brilliant tone (often replaced by the cornet); the majestic trombone, an instrument of great range and power, and the deep-toned tuba, the bass of the brass band (*see* Horn, Musical).

Of the percussion instruments, often called "the battery," some produce "noises" rather than definite musical notes. Such are the bass and snare drums, triangle, cymbals, etc., whose purpose is to accentuate the rhythm or add to the volume of sound, to help to produce various descriptive effects (*see* Drum). The kettle-drums, or *tympani*, however, which are among the most interesting instruments in the orchestra, can be tuned to sound certain notes. The bells, "glockenspiel," or "carillon," and the steel plates of the celesta likewise have a definite pitch.

A PAGE OF AN ORCHESTRAL SCORE



Great orchestral conductors often retain dozens of long scores in their memory, so that they need not watch the music during a concert but may give all their attention to the musicians. You can get some idea of what a task this is when you understand that each staff of the score represents the music for only one group of instruments.

What a marvelous thing an orchestra is! As someone has said: "It holds within itself nearly every kind of tone from the deepest rumble of the bass tuba and growl of the double-bass to the cool, flowing tone of the clarinet and bassoon and to the penetrating call of the flute, the cry of the violin, and the scream of the piccolo. It holds within itself every kind of vibration from bowed, or plucked, strings, and air blown upon quivering reeds, or through pipes, or tubes, or horns; it has every kind of thump on tightly stretched skin; it has every kind of rattle, clang, and clash; and every kind of sharp blow, from the heavy stroke on the steel rods to the silvery notes of bells, or the brilliant fiery sparks from the triangle."

Every instrument in the orchestra has been hundreds of years in developing to its present perfection (*see* Musical Instruments). So has the music it plays for us. Even the name "orchestra" comes to us from the Greek language of long ago. It meant the "dancing place" and the name came to be given to the instrument players because in the old Greek theater those players used to be placed in the circular space in front of the spectators, where the chorus danced and sang.

The early orchestras were very different from the great orchestras of today. About the time that the first white people came to live in America, the orchestras in Italy, which was then the chief home of music, had less than a score of instruments. One of the best remembered of these organizations had only seven — one harpsichord (the forerunner of the piano), one guitar, one viol, one lute, and three flutes. The great orchestra of the French conductor Berlioz, 200 years later, used 100 stringed instruments, 18 woodwinds, 49 brasses, 18 drums, three pairs of cymbals, and a gong! A modern symphony orchestra consists of from 60 to 100 musicians. A typical one is made up as follows: 16 first violins, 14 second violins, 10 violas, 10 violoncellos, 8 double-basses, 3 flutes, 2 oboes, 1 English

A FLOWER-QUEEN OF THE TROPICS

For variety of shape and color, as well as for strange habits, the Orchids lead the plant world. The one shown here is a variety of the Rosy-Lipped Cattleya (*Cattleya labiata*). It is found wild in Brazil growing on the trunks of trees. The flowers, spreading like giant butterflies, are often six inches or more across.

For any subject not found in its alphabetical place see information

horn, 3 clarinets, 3 bassoons, 4 trumpets, 4 horns, 3 trombones, 2 tenor tubas, 2 bass tubas, 1 contrabass tuba, 2 pairs of kettle-drums, bass drum, cymbals, harp, celesta, etc.

With so many instruments playing together it is very important to have a leader or conductor to indicate the time and to preserve the proper balance between the groups. How complicated his task is you realize when you look at the many lines of notes on each page of a conductor's score. Besides indicating the time and the expression the conductor also usually signals each solo player or group of players when they are to enter, if they have been silent for a few bars.

Almost every large city of Europe has at least one symphony orchestra, and there are about a dozen such organizations in the United States.

ORCHID (*ôr'kĭd*). Fabulous prices have been paid for a single rare specimen of the remarkable orchid family of plants. These flowers are so exquisite in their delicate colorings of rose and lilac, yellow, white, and green, so pleasing in their violet or orris-root fragrance, and so graceful in many of their forms, that they have become the favorites of florists and all flower-loving folk. So great is the demand that thousands of dollars' worth of them are imported annually from South America, the East Indies, the Philippines, and even from Australia. And many an eager collector has climbed precipices, waded through malarial swamps, endured all dangers of tropical forests, and braved even the head-hunters of Borneo to get these treasured flowers. Indeed, to prevent their total extinction some South American governments have put a stop to all orchid collecting.

Some orchids grow upon the ground as do so many of the other flowers, and some grow in wet marshy places and live on dead organic matter. The most valuable group are the air plants, which grow on tree trunks and branches in tropical and subtropical regions, obtaining their nourishment not from the support that some of their roots cling to but from their long spongy aerial roots which absorb the dust blowing around them as well as other food given by the moisture-laden atmosphere (*see* Air Plants).

Their flowers in color and form are often so close an imitation of queer bright-colored bees, butterflies, frogs, and lizards that the flower-destroying insects pass them by. All members of the family have various schemes for getting pollen-carrying insects to visit them. Inside the walls of the flower are tempting juices, but to reach them their insect visitor must first pass through the wonderfully constructed "lip," a conspicuously colored modified petal. These callers pay for their feast by carrying pollen masses away with them. Some orchids give their insect visitors a bath of nectar so as to make them crawl with wet wings up a certain path where they touch the pollen masses and stigma; some hurl their pollen masses at them, and others have various and no less remarkable devices to make sure that fertilization is properly carried out.

One species of orchid furnishes the vanilla of commercial use, and another the medicinal salep (*see* Vanilla). The orchids include not only the rare hot house plants but certain more familiar species, such as those delicate wild flowers of our woods, the lady's tresses and the quaint-looking lady's slippers, the most charming of which is the fragrant and dainty pink moccasin flower (*see* Lady's Slipper).

There are more than 400 genera of the orchid family (*Orchidaceae*) and the number of species is variously estimated at 6,000 to 12,000. About 75 species are in the United States (including Alaska); fully 3,000 species are under cultivation. They thrive in all parts of the world where it is not too hot or too cold, and are divided into two general groups—the East Indian and the South American. Orchids are the most highly organized flowers among the monocotyledons. These perennial herbs have simple stems, often arising from bulbs; simple leaves; showy irregular flowers with three beautifully colored sepals and three petals, one of which, the labellum or "lip" is long, fringed or saclike. The one or two stamens are united with the pistil, and the one-celled ovary contains about a million tiny ovules. The pollen is held together in masses by cobweb-like threads.

SCENES *of Grandeur and* VISTAS *of Opportunity in* OREGON

OREGON. Oregon is a part of the "last-won wilderness" of the American domain. With the state of Washington, it came directly under American rule without having first been owned and governed by some foreign power. Great Britain was sovereign of the thirteen original colonies; France ruled in the territory of the Louisiana purchase; Spain in Florida, Texas, California, the Philippines, and Porto Rico; Russia in Alaska; and the native kings in Hawaii. But the "old Oregon" territory may be said to have come under the Stars and Stripes when it first emerged from the wilderness. For although the region was claimed by Spain, Russia, and Great Britain, as well as the United States, and for 20 years the "Oregon Country" was occupied jointly with Great Britain, the title of the United States south of the 49th parallel was definitely recognized in 1846.

Extent.—East to west, 375 miles; north to south, 290 miles. Area, 96,699 square miles. Population (1920 census), 783,389.

Physical Features.—Slightly indented Pacific coast line forming the western boundary; Cascade Mountains (Mt. Hood, 11,225 feet; Mt. Jefferson, 10,200 feet; Three Sisters) separated from the low coastal range by the Willamette valley; eastern half a rugged plateau broken by a number of lakes and the Blue Mountains in the northeast. Principal rivers: Columbia, forming part of northern boundary, and its tributaries, the Willamette, Deschutes, and Snake.

Products.—Hay, wheat, oats, barley, potatoes, hops, apples, and small fruit; cattle, horses, sheep, hogs, and dairy products; gold, iron, copper, cement; fresh and canned salmon, other fish; lumber and timber products; flour and other foods.

Chief Cities.—Portland (about 260,000), Salem (capital, 18,000), Astoria (15,000), Eugene.

A PICTURESQUE STRETCH OF THE COLUMBIA VALLEY

This part of the Columbia River is known as Sheppard's Dell. At the left is the Columbia River Highway, one of the most beautiful roads in America. In the distance at the right is Crown Point.

Oregon is a state of sharp contrasts, of green forests and snow-clad peaks, of fertile valleys and bleak deserts, of thick settlements and lifeless woods and plains. Above all, it is a land of great possibilities, where nature has turned her Middle Western prose to poetry.

Along its northern boundary for 300 miles, separating Oregon from Washington, flows the blue glossy Columbia River, fabled "River of the West," once called the "Oregon." A hundred miles from the Pacific runs the white line of the Cascade Mountains, dividing Oregon east from Oregon west, breaking into slender peaks, so individual that the Indians thought of them as gods who at times threw stones at one another. Throughout the range are fir-shadowed lakes, and blue clear singing rivers. The Coast Range runs along the Pacific parallel to the Cascades, its spires breaking the long stretches of sandy beach with occasional rocky headlands. Between the Coast Range and the Cascade Mountains flows the Willamette River, joining the Columbia at Portland.

PRODUCTS OF OREGON

Here we see how Oregon's varied products of farm, forest, and factory rank in value.

West of the Cascades Oregon is a damp soft land, with mild rainy winters, often without snow. But the cold white mountains wring out the moisture of the winds blowing warm in winter and cool in summer from the equable Pacific; so when these winds blow down upon eastern Oregon they are dry and blasting, bringing hot summers and snowy nipping winters. The land, here broken by occasional "buttes" or abrupt elevations, is dusty and desert-like, the home of the sage-brush and prairie dog, unless it is irrigated. Then rich fields of wheat, oats, barley, and hay are grown, and great herds of sheep and cattle raised. The eastern boundary of the state, separating it for 300 miles from Idaho, is the Snake River, a rapid stream whose canyons 2,000 to 5,000 feet deep rival in beauty and grandeur those of the more famous Colorado River.

From the mountains everywhere timber is cut—great plumy trees of fir, pine, cedar, hemlock, tamarack, myrtle, ash, maple, and laurel—two billion feet a year; and yet the forests are almost untouched.

For any subject not found in its alphabetical place see information

FEATURES OF OREGON'S RICH AND CHARMING DOMAIN

Oregon's Rivers Yield Great Riches in Salmon and Sturgeon

Rich Milk and Butter from Fine Dairy Herds

Multnomah Falls—One of Many Scenic Beauties

Billions of Feet of Timber from the West Mountain Forests

Luscious Fruits in Abundance

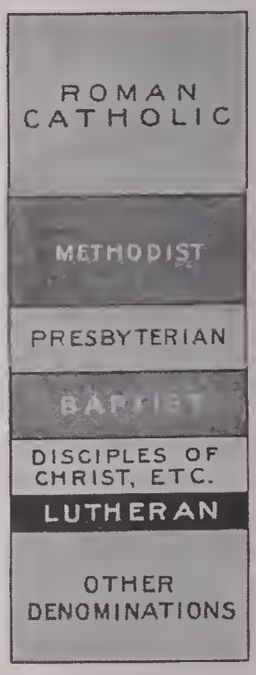
The Capitol and Grounds, Salem

West Row, University of Oregon, Eugene

Most of Oregon's wealth is the direct gift of nature, drawn from her rivers, forests, fields and orchards. And as yet she has barely tapped her resources, for practically the whole interior of the state awaits development. Fish, timber, cattle and dairy products, and fruits and vegetables are among the leading sources of wealth. The scenery of the state is superb. Below we see the state Capitol at Salem and a portion of the University of Oregon at Eugene.

contained in the Easy Reference Fact-Index at the end of this work

WEALTHY TODAY—GREATER WEALTH TO COME



Oregon has still vast untouched resources. As you can see on the map, the state is settled chiefly around its edges, while the great central basin awaits development.

The lovely Willamette valley yields farm and dairy products in abundance—world renowned apples, berries, prunes, pears, hops, and the like. And in the cold river waters are caught sturgeon and great silver salmon; of the latter alone $3,000,000 worth yearly are canned. Oregon's mineral resources are varied—some gold, iron, silver, copper, cement, coal, etc.—but mining is not a prominent industry. There are some rich deposits of clay suitable for pottery.

This prosperous country supports many excellent colleges, schools, and libraries. The state university is at Eugene. Its roads and its public buildings are extremely well made and modern. Yet in all this great state, ninth in size in the Union, there dwell less than a million souls.

A New State but Old in History

Though Oregon is so new and untouched, it was among the first to catch the eye and intrigue the imagination of ancient adventurers, and the winds of destiny swept it long before they filled the sails of the *Mayflower*. Its name was fixed upon it by the words of the poet William Cullen Bryant, whose 'Thanatopsis' mentions—

> . . . the continuous woods
> Where rolls the Oregon, and hears no sound
> Save his own dashings.

Old lore tells of the Spaniard Ferrelo, who, in 1543, was the first white man to gaze on the coast of Oregon; of Juan de Fuca, who, just one century after the great adventure of Columbus, piloted his craft through Puget Sound, where one blue strait still bears his name; of Martin Aquilar whose "rapid and abundant river," seen by him in 1602, may have been the Columbia; and of Bruno Heceta, who actually did discover the Columbia in 1775 and named it the Rio de San Roque.

But the star of Spain was setting. After the Spaniards came seaman after seaman, Russian, French, and British, seeking the Columbia, believed to be a "northwest passage" across the continent. But a curious sandbar sealed the mouth of the river to every foreign prow, even to that of the daring British discoverer, Capt. James Cook, who sailed past the river's mouth on a stormy night; and to that of Capt. John Meares, another Briton who, daunted by the breakers at the entrance, named the inlet "Deception Bay" and the northern headland "Cape Disappointment," its present official name. Fate guarded the land for the United States, and in 1792, three centuries after Columbus, Capt. John Kendrick, in the *Columbia Rediviva* and Capt. John Gray in the *Lady Washington* sailed smoothly and easily up the great river, flying the Stars and Stripes.

Their voyage, with the later explorations of Lewis and Clark and the tide of American settlement, were the basis for the United States' claim to the Oregon country. Without that region it would very likely have lost California, and without a Pacific coast the nation would have been a star of lesser magnitude, a prey to foreign intrigue.

For any subject not found in its alphabetical place see information

PORTLAND AND ITS GUARDIAN MOUNTAIN

We are looking across the city of Portland at the imposing white-clad summit of Mount Hood. Few cities can boast such impressive surroundings. At the left is the type of dwelling common in the residence sections, set amid brilliant flowers and shrubbery.

The title to the Oregon country, however, was not secured without a struggle, for it was contested by both Russia, which then held Alaska, and Great Britain, whose fur-trading companies had early established posts in the region. In the War of 1812 John Jacob Astor's trading station at Fort Astoria, near the mouth of the Columbia, was sold to its British rival. In 1824 Russia agreed to limit her claims to the territory lying north of latitude 54° 40′; and in 1827 an earlier agreement was renewed with Great Britain for joint occupation of the whole coast south of the Russian line. Not until 1846, after a loud popular campaign for "Fifty-four forty or fight," did American and British statesmen arrive at the sensible conclusion to settle the "Oregon question" by dividing Oregon country, on the line of the 49th parallel, which already separated the possessions of the two countries east of these mountains. In 1848 the American Oregon Territory (including what is now embraced in the states of Oregon, Washington, Idaho, and parts of Wyoming and Montana) was formed, and in 1859 Oregon was admitted to the Union as a state with its present boundaries.

In the early period of Oregon history the Hudson's Bay Company played a prominent part, and there is no more picturesque scene than that of old Fort Vancouver (now Vancouver, Wash.), where Dr. John McLoughlin, Scotch Canadian, held sway for that company from 1823 to 1844. Irascible, dominating,

with a fierce brush of shining white hair, the "Father of Oregon" reigned like a prince in his fortress, with palisade, watch towers, and constant sentinels. This same post was the great market for the western fur trade. Most important of all, Dr. McLoughlin extended hearty welcome to all settlers.

When four Flathead Indians from Oregon reached St. Louis in 1832, asking for the white man's "Book of Heaven"—the Bible—and Jason Lee and Dr. Marcus Whitman, with other missionaries, were dispatched to Oregon, it was Dr. McLoughlin who helped them settle in the Willamette valley. When Whitman returned east and started an immigrant train to Oregon in 1843, which was trapped by cold and hunger in the Cascade Mountains, it was Dr. McLoughlin who rescued and succored the nine hundred famishing travelers. And when the Hudson's Bay Company demanded of the great-hearted doctor on what authority he was extending aid to American immigrants, he replied curtly that the laws of humanity would always suffice him in such an emergency. The upshot was that he resigned his post, was naturalized an American, and went to Oregon City, where his ashes now lie, high on a bank over the shining Willamette.

The gold fever of 1849 swept Oregon, and opened up her mines in the hills of the Rogue and the Umpqua, around Baker City, and in the hills of the Willamette valley and on the Santiam—where, in the brittle quartz, are still found pockets of arborescent gold, in filaments and sticks, often like a bird's nest of spun gold. And on the heels of the miners came Indian wars, with the names of Chief Kamiakin and Chief Joe written in the blood of the fighting pioneers. They lasted until the Modocs' surrender in 1873. When the Civil War came, there rode to the defense of the flag from Oregon Gen. Joe Hooker and Gen. Philip Sheridan, of the famous Winchester ride.

Oregon's pathway since has been one of peace. But its smoother stages are due to the men and women of the earlier woodland trails, to those who "must blaze a nation's way with hatchet and with brand."

ORGAN. When you look at the keys of a pipe organ you see only a very small part of the organ itself, for it is the largest of all musical instruments. Sometimes above the keys of some organs you see rows of pipes that make the tones, but more often the organ is built as a part of the building, like a separate room, and the pipes, along with the rest of the machinery, are hidden behind the walls.

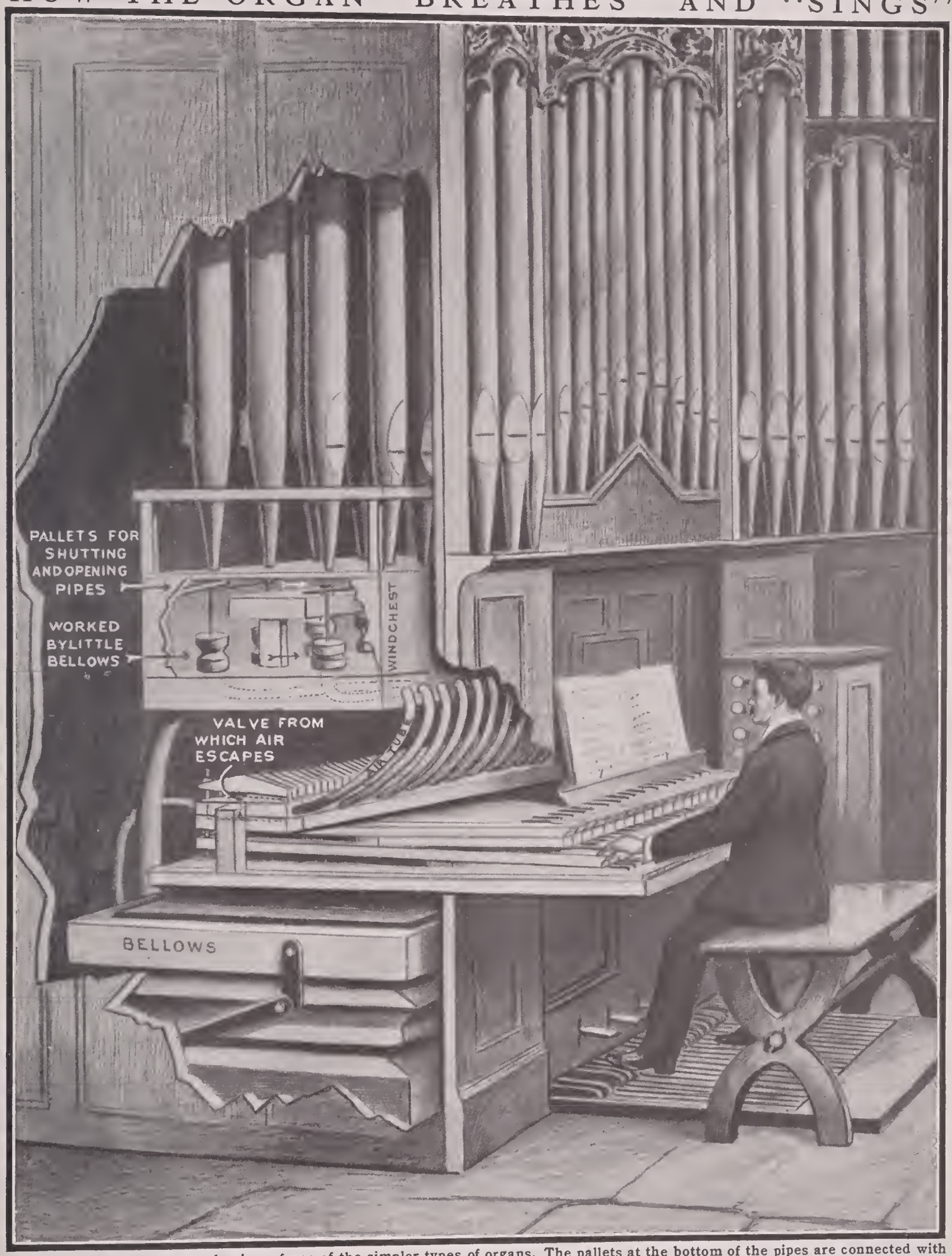
ONE OF THE LARGEST ORGANS IN THE WORLD

This organ has no fewer than 18,000 pipes and 232 stops. Imagine the difficulty of playing such an instrument, requiring the ability to do so many things at once with hands and feet! The entire organ, pipes and all, weighs 375,000 pounds; the heaviest single pipe weighs 1,735 pounds, and is 32 feet long. The longest pipe is 37 feet 9 inches long and 17 inches in diameter. The smallest pipe is three-fourths of an inch long and weighs about half an ounce. This musical giant, which stands in a Philadelphia department store, is really made up of eight "organs": great, choir, swell, solo, echo, chorus, ethereal, and pedal. In addition it has a piano, two sets of chimes, one set of gongs and a harp, all controlled by this one set of keyboards and stops.

There are hundreds and sometimes thousands of pipes. Some are as large as the trunks of full-grown trees; these make the deep heavy tones. Some are smaller than a lead pencil; these make the higher tones. The pipes are arranged in groups. Each group is controlled by a stop which is placed in reach of the organist; as he wishes to use any particular group, he opens the proper stop and thus connects it with the keyboard. The air which causes the pipes to sound is forced into them from an air chamber into which it has been pumped by a great bellows, or in some organs by an electric fan.

Some organs have as many as five rows or banks of keys. Each row is called a manual because it

HOW THE ORGAN "BREATHES" AND "SINGS"



This drawing shows the mechanism of one of the simpler types of organs. The pallets at the bottom of the pipes are connected with the keys and stops. When the organist presses down the keys, the pallets are opened by little individual bellows, one for each key. Air, compressed in the windchest by the bellows, then rushes through the pipes. The larger pipes, which produce the deeper tones, are made of an alloy of tin and lead; the smaller pipes are usually made of wood. At the right of the organist are the "stops," each of which controls a separate set of pipes. Each set differs from the others in tone value, much as the violin, for instance, differs from the flute. When a stop is pulled out, it moves the holes in a perforated bar opposite the proper set of pipes, so that air can enter when the keys are pressed.

contained in the Easy Reference Fact-Index at the end of this work

is played by the hands (from the Latin word *manus*, "hand"), and each manual is connected with a particular set of pipes. When a key is pressed down, a valve is moved which admits air to a certain pipe. The most important manual is called the "great" organ; the other keyboards control the "choir," "swell," and "solo" organs. If the organ has a fifth manual (very few organs have), it is for the "echo" organ. In the very largest instruments which have seven or eight organs, one or more of the manuals may control two organs. Besides manipulating the stops and the different manuals, the organist plays with his feet another keyboard, called the "pedal" organ. These keys are of wood and very large.

The organs of early days were very different from the organs of today. The first instrument of this type was the Pan's pipes of the ancient Greeks, which consisted of a set of pipes of different lengths bound together and made to sound by the player's breath. About two centuries before Christ a device was invented for forcing air into the pipes by water power, and keys were added to open and close the pipes. This hydraulic (or water) organ was common among the Greeks and the Romans. Centuries later the bellows came into use, instead of water-power, to furnish air. An organ built in the 10th century for Winchester Cathedral in England had a bellows so powerful that 70 men were needed to pump it. In the organs of today the power that pumps the bellows would be equal to 25 or even 40 horse-power; yet so improved is the mechanism of the keyboard that the touch of a finger is all that is required to open the pipe-valve.

The greatest changes are due to the use of electricity. So much of the machinery is now operated by this power that the inside of the organ looks like a telephone exchange. By means of electricity one person can now control the 18,000 pipes found in some of the largest organs, and by electrical devices organs are now fitted with attachments of bells, drums, harps, and even colored lights. Some of the largest organs now being built are for moving picture theaters. The self-playing organ, on the same principle as the player-piano, is a late invention that has proved very successful.

Much like the pipe organ is the reed or cabinet organ, often found in rural schools and churches. Instead of pipes it has a great number of freely vibrating "reeds," or thin strips of wood or metal of varying length and thickness, which produce the various tones. Air is provided by a bellows worked by the feet.

ORINO'CO RIVER. "I know all the earth doth not yield the like confluence of streams and branches, the one crossing the other as many times, and all as fair and large and so like one to another as no man can tell which to take." So Sir Walter Raleigh described the huge delta of the Orinoco, which he visited on his search for El Dorado in 1595. His description is not far out of the way, for this fan-shaped delta, nearly as large as the island of Sicily, is traversed by more than 50 channels and escape from it would be almost impossible by any but an experienced pilot. Indians conceal themselves in the fringes of trackless forests, where the charm of foliage and flower is enhanced by the presence of countless birds of richest plumage and dazzling hue. Monkeys disport themselves among the branches, which are hung with rare orchids and other air-plants of countless variety, and "bush ropes" or *bejucos*, cross one another from tree to tree, forming a trelliswork that is almost impassable. The soil is even more fertile than that of the Nile Valley, and produces tropical fruits in endless profusion.

Above the delta, 120 miles from the sea, even in dry season the river is no less than 12 miles in width. Ciudad Bolivar, 260 miles from the sea, is the metropolis of the Orinoco basin and the center of the river trade. The land above the delta is mostly a vast treeless grassy plain—the *llanos*—where millions of cattle, sheep, and horses feed. Portions of the upper Orinoco have been explored, but the impenetrable forest lands are still unknown.

The Orinoco is one of the largest rivers in South America. It rises in southern Venezuela, flowing west, north, and east through central Venezuela to the Atlantic. Among the most important of its hundreds of tributaries are the Guaviare, Meta, Apuré, Arauca, Caura, and Caroni. Its total length is 1,600 miles, and about 900 miles are navigable to the rapids. The river usually floods the country in its course from May to January, the overflow sometimes covering a breadth of 100 miles. (*See* Venezuela.)

ORIOLE. Orioles usually come to life in a tiny hanging nest on the tip of a high tree branch; but they are quite safe, for their little hammock

THE BALTIMORE ORIOLE

The male (above) is colored a brilliant fire orange and black, with considerable white on the wings. The female, clinging upside down to the nest below, is paler, and touched with olive.

is so strongly woven that, although made for one summer only, it will swing securely on its leafless bough even through the storms of winter.

Included with meadow-larks, blackbirds, and others of the *Icteridae* family are about 50 species of orioles, distributed throughout temperate and tropical America. They feed on fruit, insects, and the honey of flowers. The nesting habits are similar, though some nests are only semi-hanging. Orioles are not great singers, but all have sweet whistling calls. They breed north to Nova Scotia and Manitoba, but winter south through Texas and Central America. Though always richly colored, especially the male birds, they reach their highest development in the tropics.

The Baltimore oriole is the favorite of the species. The orchard oriole, about seven inches long, has rich plumage of burnt-orange and black, and a sweet song. It is of very shy disposition and more rare than the Baltimore. West of the Rocky Mountains Bullock's oriole replaces the Baltimore. It is about 8½ inches long, orange and black in color, and very social in disposition. (For illustration in colors *see* Birds.) Old World orioles, though similar in color and habit, belong to another genus, named *Oriolus*. The best known is the golden oriole, a beautiful singer, somewhat larger than the Baltimore oriole.

Scientific name of orchard oriole, *Icterus spurius;* of Bullock's oriole, *Icterus bullocki;* of Baltimore oriole, *Icterus galbula;* of golden oriole, *Oriolus galbula.*

ORI'ON. A mighty hunter of Greek legend, Orion was noted for his beauty and gigantic size and strength. According to the best known story about him, Orion was loved by the goddess Artemis (Diana), whose hunter he became. Her brother Apollo was angered at this, and one day seeing Orion swimming he pointed out to Artemis a black object in the water and challenged her to hit it with her arrow. She shot at it, finding when too late that it was the head of her lover. After his death he was placed among the stars, where he appears with a lion's skin, girdle, sword, and club, followed by his hound. The constellation of Orion is one of the brightest in the northern heavens. The three bright stars across its center are called "Orion's belt."

ORKNEY ISLANDS, SCOTLAND. Like a fleet of ships sailing from Scotland up into the Arctic Ocean lie the 70 islands of the Orkneys, windy and treeless, but noted for their bold and rocky scenery. For centuries these islands were the scene of many stirring events and bloody battles, for they were a natural stopping place for the Vikings in their voyages to the southwest. Their long black ships with monstrous figureheads visited their shores, carrying the bold warriors in their search for plunder and fame. The islands remained in the hands of the Northmen until 1468, when a needy king of Denmark pledged the Orkneys and Shetlands to James III of Scotland as security for his daughter's dowry. In default of payment they became Scottish territory, Denmark formally consenting to the transfer in 1590.

About half of the 70 islands are uninhabited. On the largest island, called Mainland, is Kirkwall, a town of about 4,000 inhabitants. Other islands worthy of mention are Westray, Sanday, Stronsay, and Hoy, the last alone being mountainous and noted for its beautiful scenery. The inhabitants are largely descendants of the Northmen. On their small farms they raise oats, turnips, barley, and potatoes, and tend their cattle, sheep, and poultry. Fishing is also a leading industry.

In the World War these islands again achieved a place in history. Scapa Flow, the capacious harbor, whose waters are shut in by three of the islands, was a safe anchorage for the British fleet in its ceaseless watch over the North Sea; and here it was that the German fleet was interned after its surrender in 1918. Kirkwall, which lies at its northern angle, was the western base from which the stupendous task of laying the great North Sea mine barrage was accomplished, chiefly by American vessels; and also the point from which, after the armistice, the no less important and hazardous task of sweeping up the mines was carried on. Area of the islands, 375 square miles; population, about 25,000.

ORLEANS (*ôr-lā-ăn'*), FRANCE. Many historic memories cling to this old French town, situated at the northermost bend of the River Loire, about 200 miles from its mouth and 75 miles southwest of Paris. It was the site of a Celtic town when the Gauls in 52 B.C. rose against Julius Caesar, and the Roman city which arose here was named *Civitas Aureliani* (in honor of the Emperor Aurelian), of which "Orleans" is a corruption. It was an important place under the Franks and their successors, and its university (founded in 1309) was an important center for the study of Roman law and the learning of the Renaissance. Later it played a part in the Huguenot wars, and in the Franco-Prussian War of 1870–71. But most of all it is known as the city besieged by the English in 1429, and relieved by Joan of Arc, the heroic "Maid of Orleans" (*see* Joan of Arc). To this day Orleans celebrates each year the anniversary of this deliverance, which was a turning point in the Hundred Years' War.

Modern Orleans is a well-constructed city with broad boulevards, pleasant squares, and bustling river quays. Its chief manufactures are tobacco, blankets and hosiery, hairpins, agricultural implements, tools, machinery, etc. The city is important as a railway center and a distributing point, but its chief interest is in its historical memorials and public buildings. These include a cathedral which dates from 1601, an important museum, much curious old timber architecture, and the house in which Joan was lodged after she had raised the siege. Population, about 75,000.

ORPHEUS (*ôr'fē-ŭs*). "The father of song," as he was called, was a legendary poet and musician of Greece. Presented with a lyre by the god Apollo and instructed by the Muses, Orpheus by his divine music not only

enchanted men and beasts, but moved trees and rocks. On his travels with the Argonauts in search of the Golden Fleece, his music put monsters to sleep and stopped falling cliffs.

When his wife Eurydice died, Orpheus followed her to the lower regions, and his "golden tones" prevailed with iron-hearted Hades (Pluto), who allowed her to follow him back to earth, provided he did not look around while they ascended. But Orpheus in his anxiety forgot this condition, looked back at Eurydice, and lost her forever.

'ORPHEUS AND EURYDICE'

This famous picture by Watts depicting a scene from the ancient myth hangs in the Tate Gallery in London.

His grief over the loss of Eurydice led him to treat with contempt the women of Thrace, where he dwelt, and in revenge, according to one story, they tore him to pieces. The Muses gathered up the fragments of his body and buried them at the foot of Mount Olympus, where a nightingale sings over his grave.

Osaka (*ō'zä-kä*), Japan. Fifty years ago there was not a piece of modern machinery in Osaka. Today the city boasts of thousands of factories and a list of manufactured goods including almost every useful commodity from soap to ships, and easily takes rank as the most important industrial center in the Far East. It has large iron works, ship-yards, cotton mills, and sugar refineries. So shrewd are the Japanese manufacturers of Osaka that they not only satisfy the demands of the present, but anticipate those of the future in a truly remarkable way. When China became a republic, millions of Chinese cut off their queues. Osaka merchants at once shipped over several million straw hats to cover the newly shorn heads. Such keen business instinct on the part of its tradespeople may be one reason why Americans refer to Osaka as "the Chicago of Japan."

Only a few years ago Osaka was more commonly called "the Venice of the East." Spread out on both banks of the river Yodo and along the shores of Osaka Bay, the city is intersected by hundreds of canals, rivulets, and arms of the sea. Its streams are spanned by 500 large bridges and by more than that number of smaller ones. Thousands of small boats, constantly moving up and down the canals, give an air of great activity. The business and manufacturing sections occupy the south bank of the river, while the shipping interests occupy the western quarter of the city.

Handicapped by a poor harbor, Osaka has been obliged to confine itself chiefly to internal trade. But 20 years ago harbor improvements were begun, to cost $25,000,000. With the completion of these Osaka becomes able to receive large ships and handle much of the foreign trade with Formosa, Korea, and China that formerly went to the port of Kobe, 20 miles distant. The bulk of the trade is in rice and tea.

In its wonderful growth, its enterprise, its modern buildings and civic improvements, the people of Osaka take great pride. They do not call the attention of the visitor to the ancient Shinto and Buddhist temples and palaces, but rather point to the fine government mint, the Y.M.C.A. building, the four acres of public playgrounds, troops of Boy Scouts, and other evidences of Osaka's modernness. Population, about 1,255,000.

Osiris (*ō-sī'rĭs*). The most popular of the gods in Egyptian mythology was Osiris, the son of Seb (the earth) and Nut (the sky). According to tradition, he was a wise and just king, who conquered all Egypt, introduced culture to the ignorant and barbarous people, and established good laws and institutions. He was slain by his wicked brother Set, who induced him to enter a cunningly-devised coffin and then cast the box into the Nile. Isis, the wife of Osiris, after a long search, discovered the body. But Set got it again and cut it into pieces, which he scattered far and wide. These the faithful and sorrowing Isis gathered and buried with due honor. Or, according to another version of the story, she joined the parts of the body together by her magic power and Osiris became ruler of the dead in the lower world. His son Horus, when he grew up, avenged his father's murder by conquering Set.

On earth Osiris became incarnate in the sacred bull Apis. From the combination of the two came the name Osiris-Apis, and from this Serapis, later regarded as a separate deity. Osiris is usually represented in human form, though sometimes with the head of an ox, ibis, or other animal. He is usually wrapped in mummy clothes, and wears a high crown, with a feather on each side. (*See* Isis.)

OSTEOP'ATHY. A system of treating disease without drugs, in the belief that disease is caused by some part of the human mechanism's being out of proper adjustment, as in the case of a misplaced bone, cartilage, or ligament, adhesions, or contractions of muscles, resulting in unnatural pressure on or obstruction to nerve, blood, or lymph. Osteopathy was first practiced by Dr. Andrew Taylor Still (1828–1917), a physician of Kirksville, Mo. (*See* Medicine and Surgery.)

OSTRICH. The "camel-bird," as the ostrich is sometimes called, not only looks like this animal, but also has some of its characteristics. For the ostrich inhabits the deserts of Africa and Arabia, will eat even the coarsest herbage, and, like the camel, is a great traveler. When running at full speed an ostrich covers 25 feet at a single stride, and is also able to outrun even the famous Arabian steeds.

The undeveloped wings and tail, the elevation of the back, the long, erect, curved neck, and the stout column-like legs give the ostrich a most unbird-like appearance. Its length of legs and neck give it a height of seven to eight feet; it weighs from 150 to 300 pounds, and is by far the largest bird in existence. In the male the feathers covering the body are a rich black. The quills of the wings and the tail feathers are pure white; these are most highly prized as plumes. The ostrich has only two toes, its chief distinction from the "three-toed ostrich" or rhea of South America.

During the breeding season one male bird may be seen with several females. These birds lay their eggs, to the total of 50 or 60, in a common nest, formed in the sand, on which the male sits at night and which the female birds take turns at keeping warm in the daytime. The brood rarely exceeds 20 or 30 in number, for many of the eggs are broken or are taken by the natives. They are good food, one ostrich egg being equal to 20 hen eggs. The shells are very thick and are often used for utensils. A single egg weighs about three pounds, and takes about 40 minutes to boil hard.

The male protects his family faithfully. If molested he fights viciously, kicking sideways or forward so powerfully that men and horses have been killed by the blow. It is he who yields the most valuable plumage, for the female is much plainer.

The male, when he desires to impress the female with his own importance, has a habit of swelling his neck, meanwhile keeping his beak tightly closed, and then slowly emitting a sound which is like the muffled roar of a lion.

The domestication of the ostrich was begun about 1850 by the French in Algiers and the English in Cape Colony. There are now about 300,000 domestic ostriches in Cape Colony alone. They bring an annual revenue of $15,000,000, for each bird yields over $50 worth of plumes a year.

In the United States there are thousands of domesticated ostriches on ranches in California, Arizona, Texas, and Florida. The breeding birds are kept in pairs and sometimes produce as many as 35 young a year. It has been found that the best results are obtained by taking the eggs as soon as laid and hatching them in incubators. The newly hatched bird is the size of a small full-grown hen and in six months is nearly the size of its parents. But the female does not mature until almost four years of age, though the birds yield plumage at the age of six months. Some specimens have been known to live to be 100 years old.

THE EXPRESS TRAIN OF THE DESERT

Full-grown ostriches run considerable distances at a speed of about 30 miles an hour.

Scientific name of the ostrich, *Struthio camelus*. Its nearest living relatives are the rhea of South America and the emu and cassowary of Australia. All belong to the group *Ratitae*, distinguished by the fact that their breast bones lack the "keel" found in all other birds.

'OTHELLO'. At the heart of this Shakespearean play, coiled like a snake, is Iago, a knave of the most surpassing cunning. Considering himself injured by Othello, the great Moorish captain of Venice, Iago goes craftily to work to wreck that open and free nature's happiness. He perceives that all the joy of Othello's life is centered in the affection of his innocent young bride, Desdemona. It is here, therefore, that Iago strikes. With diabolic skill, "honest Iago" instils into Othello's mind, drop by drop, the poison of jealousy—hinting that Desdemona bestows her love on Othello's handsome lieutenant, and contriving to bring about situations that lend color to his slander. Maddened at length with suspicion and the anguish of wronged love, the Moor strangles his bride in her bed. Then, too late, he learns what villainy Iago has practiced on him. He is seized with terrible remorse, and in agony slays himself; while Iago is led off to a well-

merited prison and torture. The play is one of Shakespeare's four supreme masterpieces in tragedy. It is Iago, hinting that Desdemona's good name stands endangered, who says—

Good name, in man or woman, dear my lord,
Is the immediate jewel of their souls:
Who steals my purse, steals trash; 'tis something, nothing:
'Twas mine, 'tis his, and has been slave to thousands;
But he that filches from me my good name
Robs me of that, which not enriches him,
And makes me poor indeed.

Poor Othello in his final speech asks only—

Speak of me as I am; nothing extenuate,
Nor set down aught in malice: then, must you speak
Of one that loved not wisely but too well;
Of one not easily jealous, but, being wrought,
Perplexed in the extreme; of one whose hand,
Like the base Indian, threw a pearl away
Richer than all his tribe; of one whose subdu'd eyes
Albeit unused to the melting mood,
Drops tears as fast as the Arabian trees
Their medicinable gum.

OTIS, JAMES (1725–1783). This early Revolutionary statesman and orator of Massachusetts, who ranks with Patrick Henry of Virginia, was graduated from Harvard University in 1743, and studied law in Boston until admitted to the bar in 1748. In 1760, while he was advocate-general of Massachusetts colony, the revenue officers of the crown asked his aid in obtaining general search warrants, known as "writs of assistance," by which they might enter any man's house in search of smuggled goods. Otis considered these writs illegal, and refused to uphold the government. He resigned instead and next year appeared in the case in behalf of the people. His five-hour speech on that occasion made a great impression, John Adams saying of it afterwards: "Otis was a flame of fire and carried all before him. American independence was then and there born." Unfortunately the only report we have of this great speech is one which Adams, then a young lawyer, wrote out from his notes.

From this time on, Otis was for some years increasingly active in the Revolutionary agitation. He was elected to the colonial legislature, and in 1765 he was sent as a delegate to the Stamp Act Congress in New York. Here he was a member of a committee that prepared an address to the English House of Commons. He wrote as well as spoke in defence of the colonies, 'The Rights of the British Colonies Asserted and Proved' (1764) being his best known pamphlet.

Unfortunately this great leader, who was called "the most able, manly, and commanding character of his age at the Boston bar," received a blow over the head from one of the British revenue officers in 1769, which led to recurring fits of insanity. Thus his able leadership was lost to the colonists before the armed conflict came. Although in an unbalanced mental condition, he took part in the battle of Bunker Hill. He was killed by a stroke of lightning in 1783.

OTTAWA, ONTARIO. A magnificent sweep of river-belted hills, fringed in brilliant green and crowned with lofty and dignified towers—such is one's first impression of the city of Ottawa, the capital of the Dominion of Canada, situated on the right bank of the Ottawa River near the eastern corner of the rich province of Ontario. A closer view reveals further beauties—picturesque tree-lined streets, parks, numerous fine bridges thrown over the rushing waters of the Rideau River, which flows into the Ottawa from the south, skirting the city to the south and east. And over all presides the group of impressive Gothic buildings on the summit of Parliament Hill, rising 150 feet sheer above the river level. Here the Canadian parliament sits, and near by are the executive offices of the Dominion government, where are administered the affairs of a country nearly as vast as all Europe.

1,000,000, Horse-Power from the Rivers

The Ottawa River, here 600 feet wide, after racing over a series of rapids, plunges downward in the Chaudiere Falls, a distance of 40 feet; and a little farther on a curtain of shimmering mist marks the spot where the Rideau pours over high rocks into the larger stream. Opposite and a little below the Rideau Falls, the Gatineau River flows into the Ottawa from the province of Quebec to the north.

Within a radius of ten miles, Ottawa has available a rush of waters capable of producing more than 1,000,000 horse-power. Much of this is already harnessed to the city's thriving industries. Below the city the Ottawa becomes navigable, forming a highway through the St. Lawrence to the sea. The Rideau Canal running southward connects Ottawa with the Great Lakes at Kingston; and the valleys of the upper Ottawa and the Gatineau lead to the city the products of the rich regions stretching away to the west and north.

The timber industry surpasses all others. Millions of feet of logs are floated down the Ottawa and Gatineau rivers every year, and are here turned into lumber, house furnishings, matches, fiber-ware, wood pulp, and paper. Meat packing, leather goods, brick and tile works, machine shops, railway car and repair shops, foundries, add to the list of thriving industries. The Canadian Pacific, the Grand Trunk, the Canadian Northern, and the New York Central railway lines meet here.

The Nearby City of Hull

Sharing the prosperity of Ottawa is the city of Hull, Quebec. It is reached by a fine steel bridge spanning Chaudiere Falls, and a much larger interprovincial bridge below the falls, which combines railway, electric cars, roadway and foot-passenger traffic. This city, which was almost destroyed by fire in 1900, has been rebuilt and now has a population of about 27,000.

Besides the group of government buildings, which includes the excellent Library of Parliament, Ottawa has two cathedrals—one Church of England and the other Roman Catholic—the University of Ottawa (Roman Catholic), several colleges and technical schools, a museum and an art gallery with valuable collections. It is also the headquarters of the Royal Society of Canada.

Philemon Wright, a New Englander who settled on the north side of the river near the end of the 18th century, may be regarded as the founder of Ottawa. In 1826, Colonel By was sent from England to construct the Rideau Canal, and his engineers and workmen established the settlement of Bytown which formed the nucleus of the present city. In 1854 the town was incorporated and its name changed to Ottawa. Four years later Queen Victoria, unable to adjust the rival claims of Montreal, Quebec, and Toronto, selected Ottawa for the Canadian capital, and it remained the capital after the formation of the Dominion in 1867.

A mysterious fire during the World War in 1916 destroyed the main Parliament building, but reconstruction was soon begun and a much larger fireproof building, though of the same Gothic architectural plan, has replaced it. Population, about 110,000, exclusive of suburbs.

Otter. If the land animals should hold a swimming and diving contest the otter would be a likely candidate for championship honors. He is so much at home in the water, diving, rising, and turning with lightning-like quickness, that he can beat the fish at their own game. In fact his food is chiefly fish.

This aquatic carnivorous animal is related to the weasel, but is much larger. It has been so much hunted for its fur, especially in America, that it is becoming very rare; but may still be found occasionally in various parts of the country from Alaska to Florida. It has an elongated body, about $2\frac{1}{2}$ feet long (exclusive of the tail), with short limbs and webbed hind feet. It is seal-like in form and is covered with a thick coat of fine dark brown fur, brighter below than above. The common otter of Europe is similar in form to the American otter but shorter.

Otters are fond of sliding down slopes into the water; and in winter they slide on the snow and enjoy coasting as well as a schoolboy. Among themselves otters are playful and affectionate, and they have been tamed, making intelligent and useful pets. Some have been trained to answer their master's whistle. In certain parts of India and China tame otters are used to catch fish for their masters or to drive them into nets. They take excellent care of their offspring, which are usually from two to five in number. The dens generally have the entrance under the water. Sometimes a nest is found under a hollow tree, again in a cave.

The sea-otter, which is much larger and heavier, and brings forth but a single pup, is a related form that belongs to another genus. It is one of the most valuable of fur-bearing animals, and a single skin will bring over a thousand dollars. It was once abundant in the Pacific from California northward, but now is very rare, save about the Aleutian Islands where it is protected by law. It is about four feet long, and has fine dense lustrous fur, almost black, sprinkled with long white-tipped hairs.

Scientific name of common otter of the Old World, *Lutra vulgaris;* of North American otter, *Lutra canadensis;* of sea-otter, *Latax lutris.*

THE CHAMPION SWIMMER OF THE LAND ANIMALS

Here the artist has shown an Otter with his captured prey, a salmon. It is said that when an Otter eats a fish, he holds his prey firmly between his paws, begins at the head, and eats down to the tail, which he leaves. His teeth are strong and very sharp. Because of the fishy flavor of his flesh and his aquatic habits, the Otter in medieval times was considered a fish. A full-grown Otter weighs about 25 pounds.

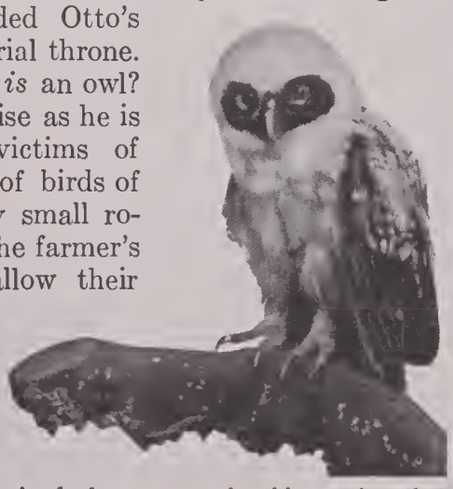
Otto, Emperors of the Holy Roman Empire. Four emperors of the Holy Roman Empire bear the name of Otto or Otho. Otto I of the Saxon line ruled Germany from 936 to 973, and in 962 reëstablished the empire of Charlemagne under the name of "the Holy Roman Empire of the German Nation." He is usually known as "the Great." He is described as having a powerful figure, a red face, a long wavy beard, and eyes that moved incessantly "as if they were watching their prey." His deeds show him to have been a man of energy, courage, and military skill. He strengthened the royal control over the unruly German dukes, conquered Italy in 952, and three years later won a great victory over the invading Hungarians (Magyars) at the battle of Lechfeld in Bavaria.

His son Otto II was emperor from 973 to 983. On the whole he maintained the gains of Otto I, but died in Rome, at the age of 28, while on an expedition to that rebellious country. He is buried in St. Peter's.

His son Otto III (983–1002) thus became German king when he was only three years old, and was crowned emperor by the pope at Rome when he was 16 (996). His mother was a learned Byzantine princess, and his tutor Gerbert (later Pope Sylvester II) was the greatest scholar of that day, especially in mathematics. The young emperor himself, however, was dreamy and impractical. With his death at Rome, at the age of 22, without children, the direct Saxon line came to an end.

Otto IV (1198–1212) was a member of the house of Welf (Guelf), was educated at the court of Richard I of England, and was put forth as a rival candidate against the Hohenstaufen Philip of Swabia. Although he gained the throne with the aid of Pope Innocent III, his course as emperor was so hostile to the church that the pope excommunicated him in favor of Frederick II. The battle of Bouvines (1214) in northern France, in which his ally John of England was defeated, ended Otto's hopes of the imperial throne.

Owl. How wise *is* an owl? Probably not so wise as he is useful, for the victims of these 250 species of birds of prey are generally small rodents, harmful to the farmer's crops. Owls swallow their food whole, and later eject from their mouths, in the form of pellets, the bones, hair, and all indigestible parts.



Anybody can see why this one is called the Spectacled Owl.

THE BARRED OWL

The Barred Owl is one of the commonest sorts found in the United States. This is a young bird, before the feathers show many stripes.

Owls see but poorly in the daylight, so that all their hunting is done at night. In daylight they sit and blink, and their reputation for wisdom, as in the case of some humans, is probably due to their solemn silence. They are distinguished from all other birds by the peculiar radiating systems of feathers surrounding their eyes. These circles are bounded by a rim of stiff recurved feathers that give the effect of a mask worn over the face. The neck is short and thick, and the legs are set so far back on the body that the bird sits in an upright position. The plumage, which is generally gray or brown mottled with lighter shades, is very fluffy and gives an appearance of great size.

The owls' nests of various kinds are found in old buildings and in cavities of rocks and in trees; sometimes the birds repair the discarded nests of hawks or of squirrels. The eggs, invariably white, are from three to five in number.

Owls are found in all parts of the world except the extremely cold regions. Because of a difference in bone construction, the barn owls are in a family group by themselves.

Most barn owls have a heart-shaped face mask with an inner circle of feathers about their small eyes. They are always hungry and are great mousers. One half-grown barn owl has gone on record as having eaten, or rather swallowed, eight mice one after another, and a ninth, all but the tail, which for a time hung from the bird's mouth, then disappeared. Three hours later the bird, being hungry, swallowed four more mice. At this rate a pair of owls would be a big asset in every barn loft.

THE BARN OWL

This is the kind which makes its home in barns and thus has acquired its name.

The barred owl is the "whoo? whoo?" questioner so often connected with ghost stories. He lives along swamps and in dense forests, where the deep booming of his call might well discomfit even a stronghearted night traveler. His plumage is handsomely striped and barred and his eyes stare as from behind immense tortoise-shell-rimmed spectacles. Some-

THE SCREECH OWL

This is a small bird, only nine to ten inches long.

times he eats small birds, but generally frogs, lizards, and mice are his diet. The burrowing owl, found on the western plains, inhabits holes dug usually by other animals. Their chief food is grasshoppers, but they eat lizards also.

The screech owl is responsible for the long, wailing, shivering night cry heard so generally throughout the middle and eastern parts of the United States. It is of this bird that the child Hiawatha speaks:

"What is that?" he cried in terror;
"What is that," he said, "Nokomis?"
And the good Nokomis answered:
"That is but the owl and owlet,
Talking in their native language,
Talking, scolding at each other."

There are eight species of screech owls, all of which have the horn-like tufts on the top of the head. They nest in trees, often in a deserted woodpecker's hole. In addition to mice they eat some small birds, but make up for this by destroying many cut-worms and caterpillars.

The great horned owl is called the "tiger of the air" for he is powerful and bloodthirsty, and the sweep of his great wings through the night air is as noiseless as the tread of the padded paws of the king of the jungle. He cannot be counted among the farmer's friends, for he is fond of domestic fowls and will repeatedly raid the farmyard. A single member of this group has been known to carry off 59 young guinea-fowl in one autumn. Rabbits are also a favorite food, and these are the only birds known to dine upon the skunk!

The snowy owl, with his white plumage, breeds in the cold regions of North America, but in the winter it travels south through the states, sometimes as far as Texas. Having grown up in the land of the midnight sun, he sees quite well in daylight and often secures his food while other owls are sleeping. On the wing he is so swift that he will overtake a grouse in flight.

The elf owl, no larger than an English sparrow, is found nesting in the giant cactus of southern Texas and Mexico. Its food is grasshoppers and beetles.

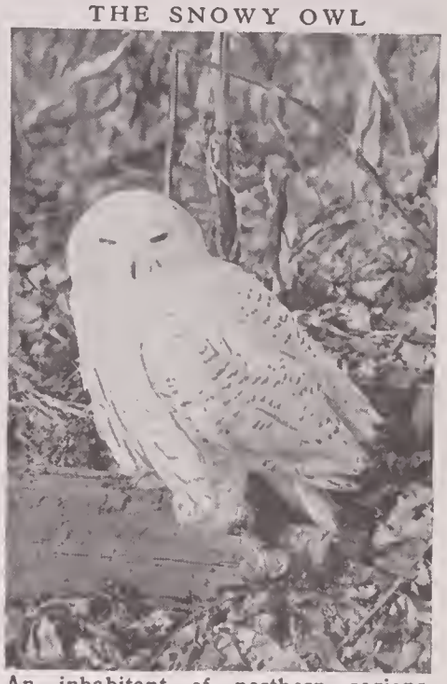
THE HORNED OWL

Also called the Eagle Owl. It is the largest and most powerful of the owl tribe.

It is seldom seen in daytime. (For illustrations in colors of barn owl and screech owl *see* Birds.)

Primitive peoples have many superstitions about owls, most of which seem to arise from their peculiar cries. In the hoot of most owls the predominant sound is *oo*, *hoo*, or *ow*, giving it an unearthly quality. Some of the smaller owls have, nevertheless, a low and melodious note. In many parts of Europe the hoot of an owl is regarded as a sign of death. On the other hand, its solemn, thoughtful air has caused its reputation for wisdom since ancient times, when it was the symbol of Athena, the Greek goddess of wisdom.

THE SNOWY OWL



An inhabitant of northern regions, where his coloring blends with the snowy surroundings.

Owls belong to the order *Raptores*, or birds of prey. Scientific name of barn owl, *Aluco pratincola;* barred owl, *Strix varia;* screech owl, *Otus asio;* great horned owl, *Bubo virginianus;* snowy owl, *Nyctea nyctea;* the elf owl, *Micropallas whitneyi.*

OXALIS. The acid taste of the leaves is a distinctive feature of the oxalis, a genus of stemless herbs. The name itself is derived from the Greek word meaning "acid," or "sharp." The 220 species are chiefly natives of tropical South Africa and South America, but are represented in the United States by the common wood sorrel, a small plant whose purplish-white flowers and clover-shaped leaves, which droop at night, spring from a creeping scaly rootstock. The fruit, a capsule, has a fleshy coat which, curling back elastically, ejects the true seeds.

The oxalis is used to advantage as a pot plant or border flower. The stalks of the oca of South America may be used as rhubarb and the leaves are often eaten in salad. The roots of a Mexican species may be boiled in salt water, peeled, and eaten like asparagus.

Family name, *Oxalidaceae. Oxalis stricta* and *Oxalis acetosella* are the common wood sorrels of the United States.

OXFORD, ENGLAND. Cupped in the purple hollow of softly swelling hills, held in the embrace of the stripling Thames and its lovely tributary the Cherwell, this famous English city is wrapped in a haze of romance and beauty. For nearly a thousand years its gray spires and towers have looked down upon an unbroken procession of great men and great events. To its venerable colleges have come England's youthful statesmen, poets, and philosophers to be nurtured in the traditions of beauty and sweetness.

Within the crumbling fronts of the Oxford colleges lived and labored the philosopher Locke and the historian Gibbon, the essayists Steele and Addison, the encyclopedic Dr. Samuel Johnson, and the reformer John Wesley. Shelley, De Quincey, and Ruskin, Newman, and Matthew Arnold have paced their moldering cloisters. Shakespeare must have slept in the quaint inns of the city as he journeyed from Stratford to London. Here Sir Robert Peel and Gladstone laid the foundations for their eminence as statesmen by taking "double firsts"—the rarest and most coveted scholastic honor that can be won at the university. Here, in the 19th century alone, ten prime ministers of Great Britain spent their student days. To mention all the illustrious men whose names are linked with Oxford would be to call the long and glorious roll of English history and English letters.

The origin of Oxford is lost in the mists of antiquity. It first rises from the haze in 737, when St. Frideswide founded her nunnery on the site of Christ Church College. A thriving market town soon sprang up, which was burned by the Danes in 1009. The oldest known architectural remains are the tower of St. Martin's Church (1034) and the castle tower (1071). In this tower Empress Matilda, daughter of Henry I, was besieged by Stephen of Blois in 1135, and escaped by fleeing over the frozen snow-covered river, clad in white to prevent detection.

Legend attributes the founding of the University of Oxford to Alfred the Great, but the first discoverable traces of organized teaching in the city are about 200 years later, in the 12th century. Hither soon swarmed students from all over the world, and by the end of the century it had an academic population of 3,000. There were as yet no university buildings, no laboratories, no endowments. "Masters" gave instruction —all in Latin—to such students as chose to attend their lectures, and their entire income came from fees collected from their pupils. They were turbulent fellows, these medieval students, and enlivened their scholastic routine by frequent bloody affrays with the townsmen, so that the "town and gown" riots of Oxford became proverbial.

The friars began building monastic establishments in the 13th century. They flocked to Oxford in such numbers that they soon aspired to the control of the university. This caused ceaseless strife between the religious orders and the ancient colleges, which was only ended when Henry VIII dissolved the orders.

During the civil wars of the 17th century, Oxford became the seat of Charles I and the Royalist court,

For any subject not found in its alphabetical place see information

ARCHITECTURAL BEAUTIES OF OXFORD

Two great churchmen, Cardinal Wolsey in the 16th century and Archbishop Laud in the 17th, left an indelible impress on the University. Wolsey founded Christ Church College, whose dining hall (4) contains a portrait gallery of famous alumni. The Tom Gate and Tower (6) form the main entrance to this college. Laud was an alumnus and fellow of St. John's (5), and became chancellor of the University in 1629, just one century after the fall of Wolsey. The other buildings shown are Brazenose College (1), the Bodleian Library (2) and Oriel College (3).

contained in the Easy Reference Fact-Index at the end of this work

IN THE FAMOUS OLD BODLEIAN LIBRARY

This is one of the corners of the University which maintains a truly 17th century aspect. The library was founded in 1602, and is particularly rich in early editions of Greek and Latin classics and in books printed by Caxton and other early English printers. In one of the alcoves are a number of books, bound in heavy oak boards and fastened by iron chains to the bookcases, just as they have been fastened for hundreds of years.

while Parliament held forth at Westminster. Several important battles of the period were fought near by.

In organization, methods, and spirit, Oxford University is strikingly different from American universities. It is made up of 21 separate colleges, each with its own history, its own income, its own regulations, and its own characteristic organization. The colleges are federated into the university much as the states are federated into the United States.

The colleges with the dates of their founding are:

University	1249	Brazenose	1509
Merton	1264	Corpus Christi	1516
Balliol	1266	Christ Church	1525
Exeter	1314 and 1566	Trinity	1555
Oriel	1326	St. John's	1555
Queen's	1340	Jesus	1571
New	1379	Wadham	1613
Lincoln	1427	Pembroke	1624
All Soul's	1437	Worcester	1714
St. Mary Magdalen (pronounced *Maudlin*)	1474	Keble	1868
		Hertford	1874

The university is an independent self-governing corporation, with its own police and its own courts. Its main functions are holding examinations, conferring degrees, and caring for the discipline of students when outside the walls of their own colleges.

Within the massive semi-monastic buildings of the colleges—each grouped around its own quadrangle of velvety lawn—the students live a life adorned by many curious survivals from medieval days. On all academic occasions, such as lectures, conferences with tutors, chapel, dinners "in hall," the undergraduate must wear his quaint short gown and his "mortarboard" cap. He must be within the walls of his own college before midnight, and he is required to pay a small fine if he comes in after the great college gates are closed at nine o'clock.

Members of the university are in residence only half the year. Most of the real reading for the degree is done during the six months of vacation. Lectures, essay writing, conferences with tutors, and reading take up from four to six hours of the average man's daily schedule during the term time. The rest of the day is given over to social life and athletics, which play a far more important part at Oxford and Cambridge than elsewhere. Every man is expected to spend his afternoons in some form of outdoor sport. There are teams enough in all the colleges so that everyone has a chance to play the game he likes best.

Rowing is by far the most popular of all sports at Oxford, and a large proportion of the students spend their afternoons on the river the academic year 'round. Besides the university "eight," each college has its own crew. The "bumping" races between the college eights every spring and the Oxford-Cambridge races in the summer have for generations been among the most famous sporting events of the world.

The college tutor is the most important cog in the Oxford educational machine. He comes into personal contact with the student to a degree unknown in the universities of other countries. Every undergraduate is under the direction of one or more of these tutors, who lays out the course of study, advises in the selection of lectures, and holds weekly or semi-weekly conferences with the student, for which the latter is usually required to prepare an essay.

For any subject not found in its alphabetical place see information

ONE OF THE MOST FAMOUS STREETS IN THE WORLD

This is the street affectionately called by Oxford students "The High." Fronting both sides of its half-mile curve are noble buildings, many, like University College on the left, strongly suggestive of medieval castles. First on the right is Queen's, surmounted by a statue of Queen Caroline, the wife of George II. Farther down on the right is another castle-like structure, All Soul's College, and back of it rises the spire of St. Mary's, the University church.

Through the Rhodes scholarships Americans and Canadians, and other British colonials have been brought to this famous old university in far greater numbers than formerly (*see* Rhodes, Cecil John). Every year sees a new group of students come from foreign colleges to enjoy the unique privileges which Oxford offers—its finely tempered combination of ancient buildings and modern learning, its traditions of sound scholarship and keen sportsmanship, the close association with fellow students and teachers resulting from the college and tutorial systems, and its unsurpassed beauties of scenery and architecture.

Oxygen. What do you suppose is the most abundant substance in the world and the most widely distributed? It is oxygen, which exists as an uncombined gas in the air we breathe, and in combination with other chemical elements forms water, sand, limestone and other rocks, iron rust, sugar, cloth, paper, and so on. About half the weight of limestone, bricks, and such materials is oxygen, and eighty-nine hundredths of water is the same substance. As free oxygen it makes up one-fifth by bulk of the whole atmosphere.

In its free state oxygen is a gas without color, odor, or taste. Oxygen, however, is very active chemically, and readily enters into combination with nearly all other elements. Sometimes heat promotes this chemical union, and sometimes moisture, as in the rusting of a knife blade. When wood burns it is a case of the oxygen of the air uniting rapidly with the carbon and hydrogen of the wood; for chemically "fire" is only the *rapid* oxidation of a substance. When oxygen thus unites in combustion with carbon, carbon dioxide, which also is an invisible gas, is formed. When oxygen unites in combustion with hydrogen, water is formed. It is easy to prove this, for if a piece of cold chinaware is passed swiftly over a flame of any sort (such as a gas flame) moisture will be condensed on it. This is an experiment which any child can easily try for himself. From the smokestack of a locomotive comes what you may call black smoke and white smoke. The black smoke is composed of fine particles of carbon which have not burned up; the white is a cloud of condensed water vapor, which soon evaporates into the air. The ashes of wood and coal are the parts which would not burn, or which when burned did not become gases.

Oxygen is necessary for all animal life. Nitrogen is necessary, too, but oxygen has a different use. It may be hard to believe that our bodies are being "burned" all the time, but this is a fact. The body tissues contain carbon and hydrogen compounds just as in wood and coal, and these are constantly being "oxidized," or combined with the oxygen in the air we breathe. In the case of our bodies the "burning"

is a *slow* combustion, but it also produces heat, which keeps us warm. If you work or exercise violently you become warmer, owing to the faster oxidation. The same chemical products are formed as in the case of the oxidation of the wood—namely, carbon dioxide and water. Breathe on a cold mirror and you will see the water vapor condensed on it.

Fishes make use of the free oxygen which is dissolved in water. This is the reason water for goldfish has to be changed, and why air is kept bubbling through tanks in aquariums where it is inconvenient to change the water. There is not so much free oxygen in water as in the air, and as a result the temperature of fishes' bodies is lower than ours. In sunlight green plants take carbon dioxide from the air, use up the carbon, and return the oxygen (*see* Carbon Dioxide and Monoxide).

Oxygen as a chemical element was discovered in 1774 by Joseph Priestley, an English chemist who made America his home in later life. Lavoisier, a French chemist, soon after this devised some experiments which proved that the oxygen discovered by Priestley was an important component of the air, and that it combined with metals to form rusts, or "oxides" as the chemists call them. Lavoisier also proved the part oxygen plays in combustion.

Free oxygen generally forms itself into molecules each consisting of two atoms of the gas (O_2). There is another form or "allotrope," as the chemists call it, named "ozone," which consists of molecules each made up of three atoms (O_3). This is produced by passing electric sparks through ordinary oxygen. It has a peculiar smell, is a powerful and rapid oxidizing agent, attacking rubber and cork, and is used sometimes as a germicide. Natural ozone is found in the atmosphere of high altitudes, where it is produced, in part at least, by the action of lightning.

The APPETIZING OYSTER *and its* TROUBLED CAREER

OYSTER. We are so accustomed to thinking of the oyster merely as a soft fleshy, flabby ingredient for stews, patties, relishes, etc., that we often forget that it is really a shellfish, with mouth, lips, gills, stomach, liver, intestine, and heart. Before it appears on the world's dining table it has lived a strange career undersea, breathing, feeding, and escaping from its enemies.

Oysters are among the most extensively eaten of all sea foods, and the oyster industry is one of the most valuable of those that utilize the sea's products. Oyster fisheries in 35 countries engage 150,000 men and women; and many millions of dollars are invested in oyster lands, boats, and apparatus.

In shallow waters oysters are taken by means of oyster tongs, which consist of two rakes hinged to open and shut like pincers.

Oysters live in beds in the shallow waters along the shores of temperate and tropical oceans and seas, but the supply in the North Atlantic exceeds that of all other waters combined. In Europe oysters are found from Norway to the eastern Mediterranean and the Black Sea. In the United States the oysters along the Atlantic coast and the Gulf of Mexico, which furnish 99 per cent of the American supply, form the most important single branch of the American fisheries, aggregating nearly one-third of the total value. Chesapeake Bay is the greatest center of oyster production in the United States, with Long Island Sound next. Baltimore and New York are therefore the country's two greatest markets for oysters.

Varying greatly in size, shape, habits, flavor, and food value, oysters exist in from 70 to 100 species. The three most important are the common European oyster (*Ostrea edulis*), the Japanese oyster (*Ostrea cucullata*), and the species found along the eastern coast of North America (*Ostrea virginica*). On the Pacific coast is a small thin-shelled species (*Ostrea lurida*); while in the deep waters off Japan a very large oyster (*Ostrea gigas*) is found. With their relatives, clams, mussels, and scallops, oysters belong to the group of mollusks called "bivalves." (*See* Mollusks.)

Oysters are very prolific, the average eastern American oyster producing 16,000,000 very small eggs. If all the progeny of an oyster survived for five generations, to its great-great-grandchildren, the heap of shells would be more than twice the size of the earth. But most oysters die in infancy, only a very small percentage surviving the two to four years before they are gathered as food. Oysters spawn once a year. The season in the Chesapeake Bay is from May to September. It is earlier in the South, later in Long Island Sound.

The eggs hatch and the young begin to swim in a few hours, and at the end of a day have formed a tiny bivalve shell. The newly hatched oyster, called larva or "spat," is a free-swimming creature, sometimes carried long distances with tides and currents. But most of the spat fall a prey to underwater enemies, or suffocate in mud or undersea growth. After a few weeks the survivors, having

HARVESTING THE CROP ON OYSTER "FARMS"

This is an oyster bed at low tide. When oyster beds are planted in shallow tidewaters near the shore, it is easy for the oyster farmer to gather those which have reached the proper size. Such an arrangement is really an under-water farm, for the owner "seeds" the area with young oysters and guards them from enemies until they are ready for market.

In this oyster farm on Cape Cod the oystermen have been gathering their crop with a dredge. They are now scooping the oysters into baskets and preparing to pack them for shipment.

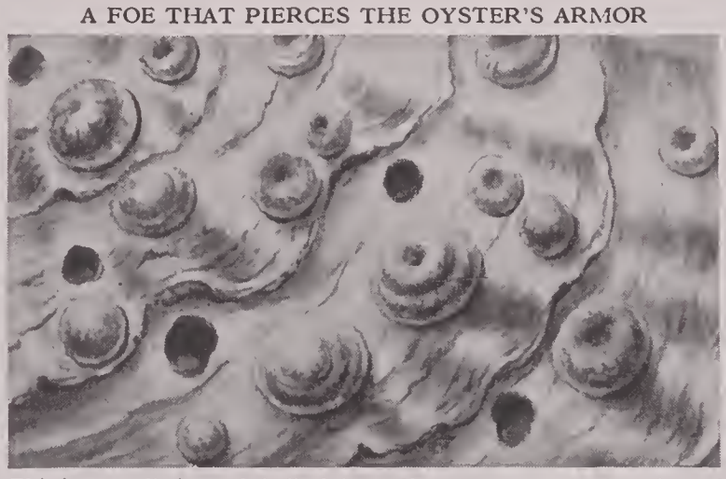
A FRENCH "NURSE" FOR YOUNG OYSTERS

In France practically every step of the industry, from planting the young oysters or "spats" (shown in the upper corner) to gathering the grown oysters, is carried on by women. This hardy old peasant has just been examining a piece of tile covered with six-months' old oysters to see if they are enjoying good health.

grown to a barely visible size, attach themselves permanently to rocks or other submerged objects, and quickly lose the swimming organ and foot. They feed on microscopic water life and grow rapidly. At the end of a month or two they are as large as a dime, and are better able to protect themselves.

Ordinarily the shell is oval, somewhat enlarged at one end, and has two halves or valves, which open and close at the hinge. The half which attaches to the submerged object becomes hollowed out as it grows, in order to accommodate the growing oyster's body, but the upper half is flattened, or even pushed in from above. The soft body of the oyster is attached to the shell by a stout muscle, which extends from one valve or half of the shell through the animal's body to the other valve and enables the oyster to tightly close its shell. A fold called the mantle grows from each side of the oyster's body, completely lines the shell, and secretes new shell. Two folds conceal the mouth, and other very large flaps form the gills. The brownish part is the liver.

A FOE THAT PIERCES THE OYSTER'S ARMOR



This is a small piece of shell of the ordinary oyster, greatly enlarged to show how it is attacked by the boring sponge. The oyster is also constantly beset by barnacles, worms, and mussels, and must struggle to keep itself free from aquatic vegetation.

Throughout its life the oyster is attacked by hordes of enemies. Many young swimming oysters are consumed by the adults and by fishes such as the menhaden, which strain their food from the water. Even the growing attached oyster, with its strong armor of shell, has a new set of shellfish enemies (called "drills") that bore holes through the valves and extract the soft parts. Sometimes starfish, moving over the bottom in great armies, as in Long Island Sound, destroy several hundred thousand bushels of marketable oysters in a season. The starfish attaches itself to the lips of the oyster shell and pulls steadily with its numerous small suckers until the oyster's muscle weakens and the shell falls open; whereupon the starfish dines on oyster "on the half shell." Among other oyster enemies are fish armed with crushing teeth like the sting ray of California, and sponges which burrow into and riddle the shell. The guardians of the oyster beds use great mops to entangle starfish, which are killed. Drills are snared by means of ingenious box dredges.

The oyster beds in the United States seemed at first inexhaustible. Owing, however, to lack of proper regulation in oyster fisheries, the beds have shown signs of failing. Through the activity of the

United States Fish Commission, the states interested have passed remedial laws. As a result oysters are now cultivated to a large extent on privately controlled beds in the United States.

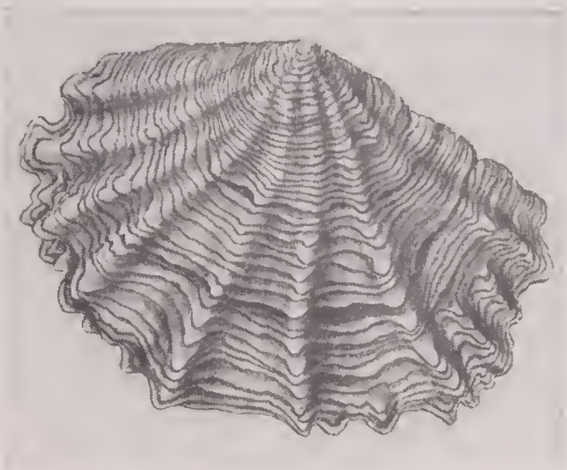
The grower generally "plants" oysters in shallow bays and coves where the bottom is firm or not too muddy, at a depth of from one to five or six fathoms, though in Long Island Sound planting is practiced to a depth of 15 fathoms (90 feet). Luxuriant natural beds are found from above low water to a depth of 20 fathoms.

Having selected his site, which he usually leases from the state, the planter marks it off with stakes and buoys, and then smooths and clears the bottom of snags and débris, either at low tide, or by means of tongs or dredges. If the bottom is too muddy it is prepared by strewing it with a layer of clean oyster shells, cinders, or similar material, to which the spat may attach themselves. But unless an oyster spawning ground is near, there will be no spat; and in this case "seed" or partly grown oysters, usually one and a half inches or more in diameter, are sown over the bottom, about 500 bushels to the acre.

For a few weeks previous to marketing many oyster farmers transfer their crop from the beds in deeper waters to warm shallows, where the greater abundance of food causes them to fatten and improve in flavor. This process must not be confused with "plumping," or "bloating," which consists simply in transferring the oysters to waters with less salt for a few days. In this case they absorb water, appearing to be fat, though in reality they are merely bloated and are robbed of much food value.

In the United States oysters are collected in two ways. In shallower waters they are taken by means of oyster tongs, which are like two long-tined rakes, hinged so as to open and close like shears. In deeper water, down to 15 or 20 fathoms, a dredge is used, dragged by power or sail boats. This is a rectangular iron framework, usually about four feet across, with sharp edges or with long teeth upon one side, while attached to the other is a large open-work bag of cord or iron. The dredge is dragged over the bottom, the oysters are caught in the bag and brought in it to the surface.

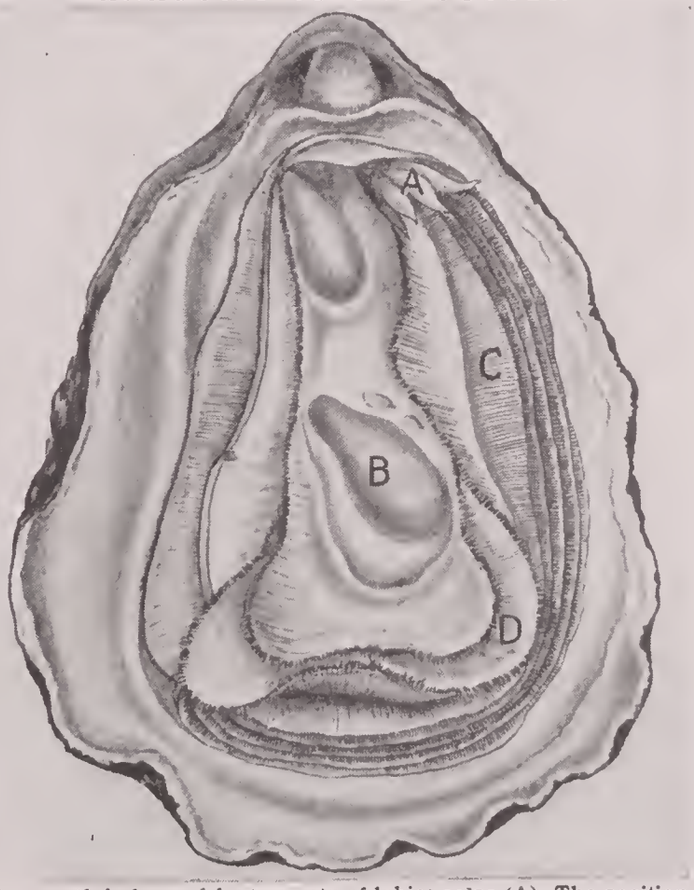
THE GREAT PEARL MAKER



While pearls have been found in every variety of oyster, the genuine pearl oyster is found principally in the East Indies. It is often eight to ten inches in diameter.

Oysters are shipped long distances in refrigerator cars or in ice, either alive in the shell or in bulk. Taking the oyster out of the shell, called "shucking," is very rapidly done by boys and women; with a short strong knife they cut the muscle that holds the valves and with another stroke scoop the oyster out. In the United States the favorite brands of oysters, such as "blue-points," "Cotuits," "cherrystones," etc., come from certain regions, the quality depending on the flavor from the water in which they were raised, shape of the shell, etc. Practically the entire yield of New England, New York, and New Jersey is from planted beds. The average annual catch for the United States is about 30,000,000 bushels, or about 10,000,000,000 oysters. About two-thirds of the catch is from the Middle Atlantic states.

ANATOMY OF THE OYSTER



The mouth is formed by two sets of labial palps (A). The position of the adductor muscle (B) is shown on an empty shell by a dark patch, marking the spot where it was attached. It is with this muscle that the oyster holds its shell closed so tightly. The gills (C) project into the mantle (D), which is the body wall.

Oysters have been under culture longer than any other water creature. A simple type of cultivation, with the formation of artificial beds, flourished in China at a very remote period. In Italy oyster culture began about 100 B.C. In the important maritime countries of Europe fully 90 per cent of the output now represents artificial cultivation. Cultural methods have attained a high degree of perfection, especially in France, Holland, and Japan. In France oysters are cultivated in oyster parks. The "spat" is collected on fagots of brush, tiles, or other collectors

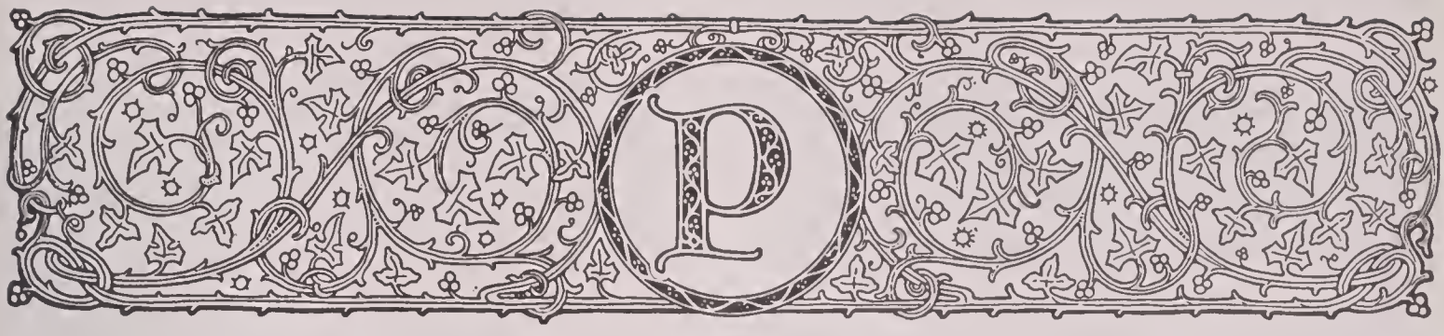
placed near spawning beds. The "seed" oysters are then removed to partially inclosed grounding-ponds admitting the tides through sluices and flood gates. When fully grown the oysters are fattened and flavored in small inclosed ponds or "claires." While in these their diet gives them a green color. The Japanese methods are simpler. The farms are in shallow brackish water, where the great rise and fall of tides leave large areas exposed at low water. They are laid out with reference to the direction of the currents, and each is inclosed by a bamboo fence or hedge. This area is then planted with bamboo stakes stuck into the ground and variously laid out in straight parallel fences with suitable alleys and aisles, or in groups arranged in rows, circles, etc. These collect the spat and hold the growing oysters.

OZARK MOUNTAINS. The Ozarks, a group of high hills lying chiefly in southern Missouri and northwestern Arkansas, are really the remnants of a former plateau into which valleys have been cut by streams. Extensions of the hills may be found in southern Illinois and for some distance into Kansas and Oklahoma. They range in altitude up to about 2,000 feet above sea-level, the highest point being Pilot Knob in Iron County, Mo.

These hills afford some of the most beautiful scenery of the Mississippi basin. Between great rock cliffs are deep narrow valleys, where lie clear rapid streams and wonderful springs. There are a number of great caves, many miles long, which contain hidden streams and great halls and galleries adorned with stalactites. There are also numerous groups of mineral springs, and these, with the attractive scenery and healthful climate, make some localities of the Ozark Mountains popular resorts. Among the well-known mineral watering places are Excelsior, Pertle, and Sweet Springs. Much of the mountains is covered with forests, principally hardwood. The mineral deposits of the region are extensive, and include coal, iron, and lead. The people of the Ozarks are mainly of Anglo-Saxon stock, but like the mountaineers of Kentucky and Tennessee the poverty of those who live in the poorer parts of the region has retarded their progress.

IN THE OZARKS

Cliffs, high and low, topped by abundant vegetation, are typical of this region.



The LURE *of the* PACIFIC *and Its* JEWELED ISLANDS

Forget the smoke and noise of the city and the busy toil of farm and factory, and fly on the magic carpet of your dreams along the golden trail of the setting sun, which leads over the blue vastness of the Pacific to the enchanted islands of romance.

PACIFIC OCEAN. Stretching 9,300 miles from the Arctic Circle at Bering Straits to the frozen seas of the South Polar zone, and nearly halfway around the earth along the Equator, from the coast of South America to the tip of the Malay Peninsula, this giant of waters occupies one-third of the earth's surface, a region of mystery and adventure greater than all the land area of the world combined. It is the deepest of oceans, averaging two and a half miles, and reaching its maximum near Mindanao, where yawns a watery chasm measuring 32,088 feet,—3,086 feet deeper than the tallest mountain of the Himalayas. It washes the shores of four continents—North and South America, Asia, and Australia—and its waters mingle in the southeast with the Atlantic Ocean, and in the southwest with the Indian Ocean.

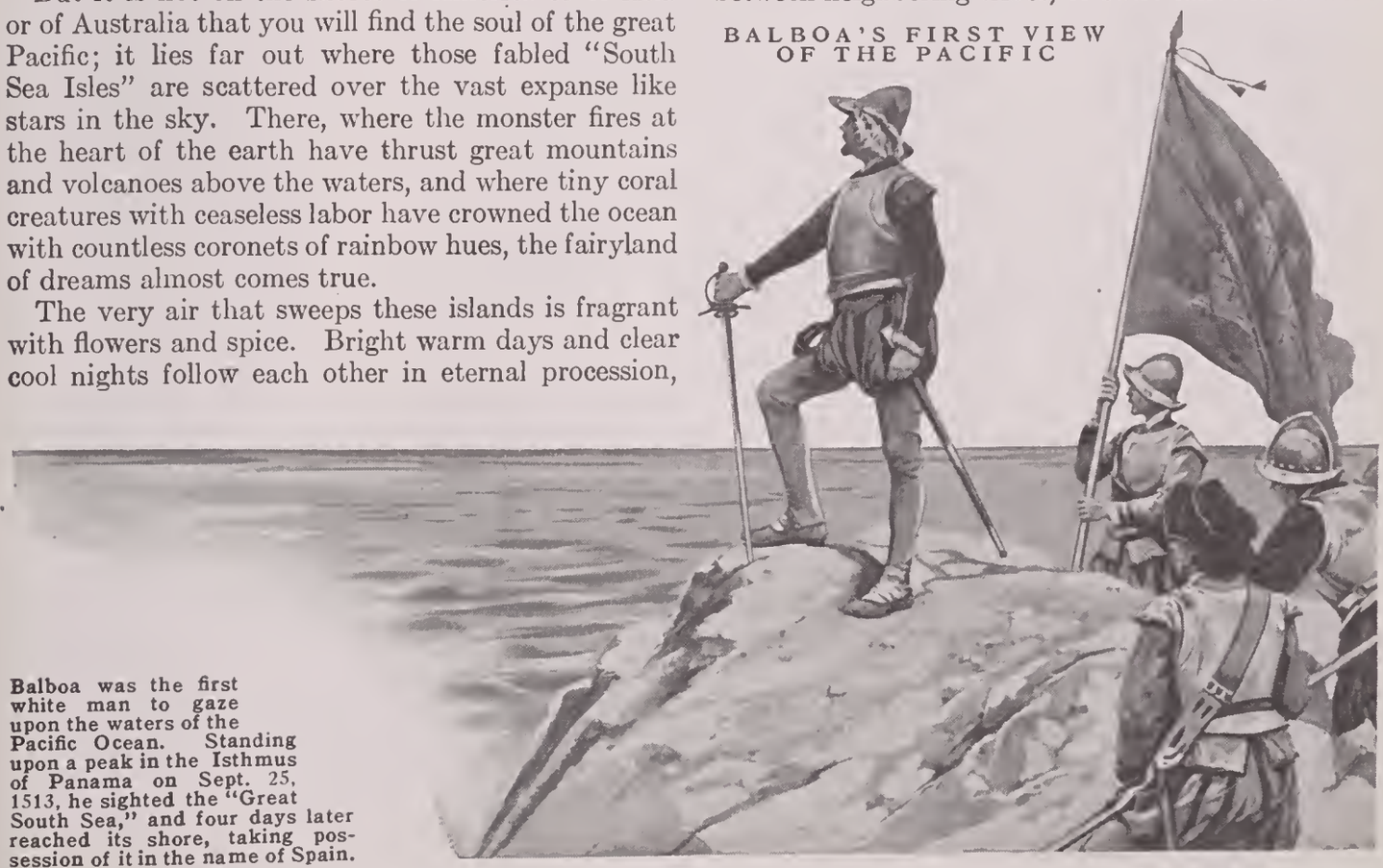
But it is not on the shores of America or of Asia or of Australia that you will find the soul of the great Pacific; it lies far out where those fabled "South Sea Isles" are scattered over the vast expanse like stars in the sky. There, where the monster fires at the heart of the earth have thrust great mountains and volcanoes above the waters, and where tiny coral creatures with ceaseless labor have crowned the ocean with countless coronets of rainbow hues, the fairyland of dreams almost comes true.

The very air that sweeps these islands is fragrant with flowers and spice. Bright warm days and clear cool nights follow each other in eternal procession, while the rolling swells break in never-ending roar on the dazzling shores, and overhead the slender coco-palms whisper their soft and drowsy song. Truly this great sea deserves its name, given by Magellan, of the Pacific or "peaceful" Ocean.

When white men first landed on its islands, they appeared as Paradise was before the curse of Adam compelled men to earn their bread by the sweat of their brow. The inhabitants were like happy children who never grew up. Tall magnificent men and handsome women they were for the most part, and apparently they had not a care in the world. Coconuts and breadfruit grew wild at the doors of their huts. The surrounding waters were filled with turtles and fish, ready for the net. For clothing they had little need. Disease was virtually unknown.

Occasionally cruel and bloody wars broke out between neighboring tribes, or swift canoe raids were

BALBOA'S FIRST VIEW OF THE PACIFIC



Balboa was the first white man to gaze upon the waters of the Pacific Ocean. Standing upon a peak in the Isthmus of Panama on Sept. 25, 1513, he sighted the "Great South Sea," and four days later reached its shore, taking possession of it in the name of Spain.

THE "OUTRIGGER" CANOES OF THE ISLANDERS

Nearly all the canoes used by the Pacific islanders are extremely long and narrow. Indeed, they would always be tipping over if it were not for the outrigger structure—a set of poles projecting from the side, at the end of which is fastened a float which rests on the surface and holds the craft steady. When they want to make speed, the paddlers tip their canoe slightly so the outrigger is raised clear of the water. The men shown here are natives of the Admiralty Islands.

made on nearby islands; but the brown warriors were athletic and brave, and found fun in fighting. It is true many of them were cannibals, who cooked and ate the enemies they killed; but this was part of their island law and religion. At most times these smiling savages were friendly, courteous, and hospitable.

All these things the first explorers found and wondered at, frequently becoming so fascinated with the South Sea lure that they forgot their homes and settled down among the natives for the remainder of their days. But today the bloom of the Pacific is gone, like a delicate flower that drooped and faded at the white man's touch. The jeweled islands are still there, and the coconut palms and the dazzling beaches kissed by the soft breezes; but the peoples who used to live in such carefree happiness are rapidly vanishing. On certain islands, where a hundred years ago thousands lived, a few score perhaps are left. Diseases — tuberculosis, small-pox, measles, leprosy, and many others—were left in the wake of the great sailing vessels or in the trail of the steamer's smoke.

A SAMOAN WARRIOR ON DRESS PARADE

This is the sort of costume the Polynesians used to wear for ceremonial occasions in the old cannibal days.

The bodies of the islanders, from time immemorial free from the attack of disease, had slight power to resist sickness; so they fell, and continue to fall, easy victims to the scourges of civilization. Even measles, which we count a minor ailment, killed them by the thousand.

Such was the tragedy of the Pacific. In another hundred years there will be left scarcely a single pure-blooded member of what a great missionary once called "the noblest of all primitive races."

The story of the Pacific confronts us at the outset with one of the mysteries of archaeology. Scattered through the island groups from one side of the ocean almost to the other are found the remains of an ancient race of skilled builders. Ruins have been discovered of huge altars, tombs, and dwellings built of great blocks of stone carefully fitted together without mortar. Traces exist in some places of houses built out over the sea, of canals, and of gigantic piers and breakwaters. On tiny Easter Island, 2,000 miles from the coast of South America and over 1,000 miles from any other inhabited island, are found great walls and

platforms 30 feet high, surmounted by pedestals upon which once stood colossal statues, now lying near by. These statues, crumbling with age, still show resemblance to the human form. The largest is 37 feet high, and in a quarry on the other side of the island is a figure half cut out from the volcanic rock, which measures 70 feet. On some of the stones are traced geometrical figures and the shapes of animals.

Who were these builders, whence did they come, and whither did they go? The natives who lived on these islands when the white men first arrived knew no more about the puzzle than we do today.

Let us now take a glance at the map of the Pacific. The western shores of the Americas, we see, are remarkably unbroken, the coast islands off southern Chile, the Gulf of California, and the long chain of Aleutian Islands off Alaska being the only important features. With the exception of the Aleutians, the Galapagos, and the Juan Fernandez groups, there are no deep-sea islands off the American coast for a stretch of 2,000 miles.

To this shore line, the coast of Asia presents a great contrast. It is broken by numerous great bays and land projections and skirted by a series of large islands, which mark off parts of the Pacific important enough to be named as separate seas. From north to south these are Bering Sea, bounded by the Aleutians; the Sea of Okhotsk, set off by the peninsula of Kamchatka and the Kurile Islands; the Sea of Japan, between the islands of Japan and the mainland; the Yellow Sea, formed by Korea; and the China Sea, inclosed by the coast of Indo-China, the Malay Peninsula, the island of Borneo, and the Philippines.

The waters between the southeastern corner of Asia and the continent of Australia are crowded with a group of large islands, variously called the East Indies or Malaysia or the Malay Archipelago. The Philippines and Borneo have been mentioned. The others are Sumatra, Java, Celebes, and New Guinea. These, as well as New Zealand, are not usually classed as Pacific islands; their story is told under their separate names. (*See also* East Indies.)

The smaller Pacific islands, often called by the general name of Oceania, form a sort of watery "Milky Way" 8,000 miles long, from Japan and the Philippines to distant Easter Island. They are mostly divided up into clusters or groups, each with its own name. These groups in turn fall into three great divisions, according to their position and the character of their native population.

The first division is Melanesia ("islands of the blacks"), forming a long crescent of good-sized islands, stretching from the coast of New Guinea southeastward toward New Zealand. The principal

THE MYSTERIOUS STONE MEN OF EASTER ISLAND

Who were the ancient sculptors who carved these stone images found on Easter Island, separated as it is by 1,000 miles of deep ocean from the nearest inhabited land? So far no one has found an answer to the puzzle. Cut out of gray stone, many of the figures were crowned with red stone "hats," as you see here.

A HOUSEBOAT OF THE SOUTH SEAS

The outrigger canoes of the Santa Cruz islanders are built with a double platform, on one of which sits the crew while at work, while on the other is built a sleeping hut. Long voyages are made in such flimsy craft, which are built to carry a big triangular sail.

groups in Melanesia are the Bismarck Archipelago, including New Britain and New Ireland, with their batteries of active volcanoes; the Solomon Islands, where dwelt the most savage and uncivilized cannibals; the Santa Cruz Islands, where many early missionaries fell victims to poisoned arrows; the New Hebrides, with their government conducted jointly by France and Great Britain; and, at the end of the crescent, the large island of New Caledonia, an old French convict colony, with the Loyalty Islands near by.

The natives of Melanesia are for the most part negro-like in appearance, with thick lips, very dark skin, and curly hair. They are closely related to the Papuans of New Guinea. Their social and political customs are crude, but they have all the negro's skill in savage arts. They are perhaps the most energetic and industrious, and yet the least civilized, of the Pacific islanders.

North of Melanesia lies the division called Micronesia ("small islands"). This consists of close-packed groups of tiny islands, some of volcanic origin, others merely atolls, as the peculiar ring-shaped coral islands are called. The principal groups are the Marianas or Ladrones to the north, which include the United States' possession of Guam (*see* Guam); the Pelew Islands, with their amazingly fertile soil; the widely scattered Caroline Islands, famous for their strange prehistoric ruins; the Marshall Islands, where dwell the boldest and most skilful navigators of the Pacific; and the crowded Gilbert Islands, formerly noted for the fierce cruelty of their inhabitants.

This Melanesian youth from one of the islands near New Guinea must be the talk of his village. For above all things, his people admire small waists and well-spiked noses.

In general the natives of Micronesia are of mixed black, brown, and yellow strains. Malay and Chinese characteristics mingle with strong traces of Papuan blood, but these peoples are generally more handsome and of higher intelligence than the Melanesians.

The "Many Islands"

The remaining great groups of islands, which occupy the center of the Pacific, fall into the division called Polynesia ("many islands"), and it is among these that the true South Sea romance dwells. The Polynesian men are among the tallest in the world, averaging on some islands six feet in height. The women are often beautiful, even according to the highest European standards. The race is light brown in color, with straight black hair; and some scientists trace it to the same Caucasian stock in the New Stone Age from which the white race of Europe sprang. The intelligence of these Kanakas, as they are sometimes called, is high, and their

manners set an example to many white visitors. In their happy and indolent life they long ago lost the desire to work, as well as much of their skill in manual arts; but their political and social organization was in the past the highest in the Pacific.

The chief groups of Polynesia are the Hawaiian Islands, the Fiji Islands, and the Samoan Islands. (Each of these is treated in a separate article.) Of the other groups, the most important are the Ellice Islands, chiefly of coral formation; the Tokelau Islands, whose inhabitants are perhaps the boldest swimmers in the world, parties of men and women frequently pushing out into the open sea and attacking man-eating sharks with no other weapons than long knives; the Tonga or Friendly Islands, with their wonderful political organization under native rulers; the Cook Islands, one of the most picturesque groups in the Pacific; the Society Islands, including beautiful and romantic Tahiti, far-famed for the songs and poetry of its people; the Tubuai or Austral Islands, famous for their native sailors; the Tuamotu or Low Archipelago, consisting of innumerable coral islands noted for their shell fisheries; and last of all the Marquesas Islands, whose natives are said to surpass all other islanders in beauty, but whose population has been reduced by disease from 50,000 in 1850 to less than 3,500 today.

The religion of most of the Pacific islanders was marked by strong superstitions and faith in magic. Most conspicuous was the widespread practice of *tabus*, or religious prohibitions. This was often used in place of laws to protect the persons of chiefs, to safeguard crops, to shut out the people from certain temples or houses, and for scores of other purposes. To eat *tabu* food, to lay hands on a *tabu* person, to enter a *tabu* dwelling, brought upon the offender, according to native belief, grave misfortune or even death (*see* Magic).

A GIRL OF TAHITI

The women of the western Pacific islands are graceful, intelligent, and often beautiful, even according to white standards. This girl is typical of many found in the more civilized islands. She shows a touch of Chinese blood. The Chinese have intermarried to a great extent with the Polynesians.

According to many native legends, the Polynesian race spread out originally from the island of Savaii, in the Samoan group, colonizing one after another the islands to the north and east. Modern scientists believe that these peoples came from the mainland of Asia, some 3,000 years ago or more, passed through the Malay Archipelago, and thence made their way in great canoes to the outlying groups. The prehistoric builders were perhaps exterminated or driven away. One theory connects these Polynesian peoples with the Inca race of South America.

A great contrast exists between the coral atolls and the volcanic islands of the Pacific. The ringshaped or horseshoe atolls, which may be from one to 100 miles in circumference, are low, sometimes rising only a few feet above the surrounding waters. They are fringed with cocopalms, and here and there in the shallow soil grow pandanus trees, which provide not only a fruit, but timber, dye, and leaves for thatching and making hats. Rats and land crabs are the only animals, but the surrounding waters teem with varied fish. The coral reef usually has one or more openings, leading to the lagoon within, which forms a natural harbor. In the lagoon, too, fish abound, but for some reason their meat is frequently poisonous, while the same species caught outside the lagoon will be safe food.

ROYALTY IN THE PACIFIC

Here you see a king and queen of the Marshall Islands in European dress, taking a walk through their island domain. They still retain their titles, though all real power is in the hands of a Japanese governor.

GAMES AND GAMBLING IN THE TONGA ISLANDS

South Sea Islanders are so fond of games of skill and chance that in the old days they would sometimes stake even their freedom, the loser becoming the slave of the winner. The men here are playing lafo, which consists of pitching coconut disks so as to knock an opponent's disk off the mat.

The volcanic islands have an entirely different appearance. Their sharp rocky mass rises suddenly from the sea, often to great altitudes, forming impressive mountains, whose rough outlines are softened by a dense growth of luxurious vegetation. Here rain is more abundant and the rich soil supports countless valuable plants and trees—the taro, whose roots ground into paste and allowed to ferment form the famous native dish called *poi;* the banana, yam, sago-palm; and the indispensable breadfruit. Here also grows the paper mulberry, whose inner bark is pounded into *tapa* cloth, so widely used for mats and clothing throughout the islands. Wild pigs and goats, descendants of those set free by the early explorers, overrun many of the larger islands, and countless birds of bright plumage dwell in the forests of the interior.

But everywhere, on islands large or small, the coco-palm waves its plumes over the land where it remains king. This palm is the fairy godmother of the native. It gives him food, drink, a roof for his house, and fiber

THE PIGS, THE CHICKENS, AND THE DINNER GUESTS

These Samoan folks evidently have company for dinner, because they are roasting pigs. It is contrary to Samoan etiquette to kill pigs or chickens for anybody but guests. When members of the family become very hungry for meat, they go out and invite to dinner the first person they can find.

For any subject not found in its alphabetical place see information

THE BIG BASKETS THE SAMOANS CALL HOME

The natives of Samoa display extraordinary skill in weaving these round basket-work huts, which they thatch with palm leaves. Such huts are airy, waterproof, and very well suited to the mild climate of the islands. With a home like this in the midst of a grove of coconuts or breadfruit trees, there is no need to worry about the future.

for his baskets, ropes, and fishing nets. And in addition the dried coconut kernel, called *copra*, is the chief article of island trade, and often takes the place of money in business transactions.

Another valuable article of commerce is trepang or bêche-de-mer, highly valued as food by the Chinese. It is prepared from the dried bodies of certain large sea slugs (*see* Sea-Cucumber).

In recent years many of the western Pacific islands have been found to be composed largely of phosphate of lime, highly prized as a fertilizer, and this has been dug out and exported on a large scale. Several of the larger islands yield important quantities of metal ores. New Caledonia, for instance, is one of the world's chief sources of nickel.

The climate of the central Pacific is generally very equable, for the natural heat of the tropics is tempered by the constant ocean winds. But in the west typhoons and hurricanes frequently do great damage and occasional tidal waves set in motion by submarine volcanoes sweep over coast settlements.

Vasco Nuñez de Balboa from a mountain top in the Isthmus of Panama discovered the American waterway of the Pacific Ocean in 1513. Seven years later Ferdinand Magellan sailed around South America and crossed the Pacific to the Philippines, where he was killed. He sighted few islands on the way, and stopped only at the Marianas. As early as 1512 the Portuguese were entering the Pacific from the western side, following Vasco da Gama's voyage around the Cape of Good Hope. Little was accomplished, however, in the way of wider exploration until the 17th century, when the Dutch entered the field, in the person of Abel Tasman, and explored Tasmania (Van Diemen's Land), New Zealand, the Tonga Islands, the Tuamotu group, and the Bismarck Archipelago. The following century Jacob Roggeveen explored Samoa and the neighboring islands. Samuel Wallis and Philip Carteret, acting for Great Britain, and De Bougainville for France carried out other important voyages of discovery.

The greatest of all these explorers, however, was Capt. James Cook, who between 1769 and 1778 made three long trips, visiting nearly all the important eastern groups, including the Hawaiian Islands, where he was killed (*see* Cook, Capt. James). Vancouver and many others followed where these bold mariners had opened the way.

With the close of the period of discovery, in the second quarter of the 19th century, numerous scientific expeditions were organized to study the formation and the life of the Pacific Islands, the most famous being those of Charles Darwin, in the British warship *Beagle*, and A. R. Wallace. On their heels came traders, seeking copra, trepang, pearls, tortoise shell, and sandalwood. Whalers and sealers also visited the islands, to refit their vessels and get wood and water. Upon them rests much of the blame for the islanders' misfortunes, for many of the traders, and their rough half-pirate crews, treated the natives with great barbarity, imported alcoholic drinks, and helped to spread disease.

DANCING WITH THE HANDS INSTEAD OF THE FEET

In the Pacific islands as in Oriental countries, the feet are not used at all in many of the native dances. A chorus of men or women will tell a long dramatic story by movements of the hands and upper part of the body. Often the entire dance is performed seated. The girls we are looking at are doing a standing dance. The men in front are playing on drums made of large gourds.

Deserters and shipwrecked sailors often settled in the more hospitable islands, defrauding the inhabitants in trade and exerting evil influences on island politics. These men, who lived from hand to mouth on the bounty of the natives, came to be known as "beach-combers," a name still applied to the shiftless and drifting white population found scattered over the Pacific.

The practice of kidnapping natives for the South American and Australian labor markets, which prevailed for many years, led to many bloody conflicts with the island tribes. Together with the activities of the "beach-combers," these made exceedingly difficult the work of the missionaries, who began their work among the islanders at an early date. Today virtually all the inhabitants of Polynesia and Micronesia profess Christianity, though many of the old religious beliefs are secretly kept alive.

One of the most romantic tales of the Pacific centers about Pitcairn Island, a tiny isolated rock rising 2,000 feet from the sea, southeast of the Tuamotu Archipelago. Here, in 1790, nine mutineers from the British ship *Bounty*, accompanied by six Polynesian men and 12 Polynesian women, sought refuge from the law. They burned their vessel and started to build homes. Disorder and bloodshed followed, and within ten years only one Englishman, John Adams, with eight women and a number of children were left alive. When this strange colony was discovered, in 1808, Adams had restored order and Christianized his people. The island was annexed to Great Britain in 1839, and 17 years later its people, about 200, were removed to Norfolk Island, northwest of New Zealand, but a number of them returned later. Today Pitcairn has about 200 inhabitants, nearly all descendants of the original settlers. They are Seventh-Day Adventists, choosing their own pastor and magistrates, leading the "simple life," and living on the products of the community farms.

With the exception of Easter Island, which belongs to Chile, and the Galapagos, which belong to Ecuador, all the Pacific islands are divided among the British Empire, France, Japan, and the United States. Before the World War of 1914–18, Germany owned the Bismarck Archipelago, part of the Solomon Islands, part of Samoa, the Carolines, the Marianas (excepting Guam), the Marshall and Pelew islands. In the peace settlement, all those north of the Equator, which include the last four, were turned over to Japan, and the others were distributed between Australia and New Zealand, under "mandates" from the League of Nations.

The other principal Pacific groups are divided as follows: To Great Britain—Fiji, Santa Cruz, Solomon, Gilbert, Cook, Ellice, Tokelau, and Tonga islands. To France—Loyalty, New Caledonia, Marquesas, Tuamotu, Society, Tubuai, and Wallis islands, the latter adjoining Samoa. To the United States—Samoa (part), Guam, and the Hawaiian Islands, with their many small dependencies, chief of which are the Midway Islands, used as a cable station. To Japan—Bonin Islands, north of the Marianas. The total population of the islands named is roughly estimated at one million.

The Pacific Ocean today is the region where the great nations of the world chiefly compete for commercial and political supremacy. The rich trade with the Orient, especially with China, is a great spur to rivalry. Japan is on the ground, and Great Britain, through her colonies of Australia and New Zealand, not only possesses large markets near by, but is in a position to control important lanes of ocean travel.

For any subject not found in its alphabetical place see information

PHYSICAL MAP
OF
PACIFIC OCEAN
SCALE OF MILES
0 500 1000 1500 2000
Railroads
Steamship Routes
(Distances in Nautical Miles)
Hammond's Physical Map of Pacific Ocean
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D 17
80° 100° 120° Longitude 140° East from 160° Greenwich 180° Long
60° 80° 100° 120° 140° 160°
60° 40° 20° 0° 20° 40°
Desert of Gobi
Plateau of Tibet
Peking
Tientsin
Shanghai
Canton
Hongkong
Hanoi
HAINAN
Bangkok
GULF OF SIAM
MALAY PEN.
Singapore
SUMATRA
BORNEO
CELEBES
JAVA SEA
Batavia
JAVA
Sunda Islands
FLORES SEA
TIMOR
TIMOR SEA
Recorder Deep
Palmerston
Gulf of Carpentaria
Townsville
CORAL SEA
INDIAN OCEAN
North West C.
Shark B.
AUSTRALIA
Perth
Albany
GREAT AUSTRALIAN BIGHT
Jeffreys Depression
Adelaide
Melbourne
Bass Str.
TASMANIA
Hobart
Sydney
Canberra
Brisbane
Darling R.
Murray R.
Spencer
L. Eyre
L. Torrens
Murray R.
TASMAN SEA
NEW ZEALAND
Wellington
Christchurch
Dunedin
SOUTH I.
NORTH I.
Auckland
North C.
Kermadec Trough
Tonga Trough
Pengu
TONGATABU
Suva
FIJI IS.
NEW HEBRIDES
SANTA CRUZ IS.
LOUISIADE ARCH.
BOUGAINVILLE
ISABEL
SOLOMON IS.
LAGOON OR
ELLICE IS.
PHOENIX IS.
BAKER IS.
GILBERT IS.
NAURU
MARSHALL IS.
JALUIT
KUSAIE
CAROLINE IS.
GUAM
LADRONE IS.
Ladrone Basin
MICRONESIA
Yap to Yokohama
Manila to Yap
Philippine Basin
PHILIPPINE ISLANDS
LUZON
Manila
MINDANAO
YAP
PELEW IS.
TULUR IS.
MOLUCCA IS.
CERAM
BURU
BANDA SEA
KEI IS.
AROO IS.
TIMOR LAUT
ARAFURA SEA
NEW GUINEA
EAST INDIAN ARCHIPELAGO
Torres Str.
GREAT BARRIER REEF
SOUTH CHINA SEA
CELEBES SEA
PALAWAN
Sulu Sea
FORMOSA
Bashi Str.
EAST CHINA SEA
YELLOW SEA
Seoul
Fusan
Nagasaki
KIUSHU
Shanghai
Yangtze R.
Vladivostok
JAPAN SEA
HONDO
Tokyo
Yokohama
Tuscarora or Japan Trough
Yokohama to Vancouver
Yokohama to Honolulu
YEZZO
KURIL IS.
SAKHALIN
C. Lopatka
SEA OF OKHOTSK
Stanovoi Mts.
Yablonoi Mts.
Khinghan Mts.
L. Baikal
Amur R.
Anadir
BERING S
KOMANDORSKI I.
ALEUTIAN ISLA
Aleutian Trough
MIDWAY I.
TROPIC OF CANCER
Monday
Sunday
International Date Line
Suva
Tonga Trough
Kermadec Trough
NORTH
OC
ASIA
Mekong R.
Hanoi
Yangtze R.
Amur R.
Sunda Islands
Torres Str.
Gulf of Carpentaria
Bass Str.
Hammond's Physical Map of Pacific Ocean
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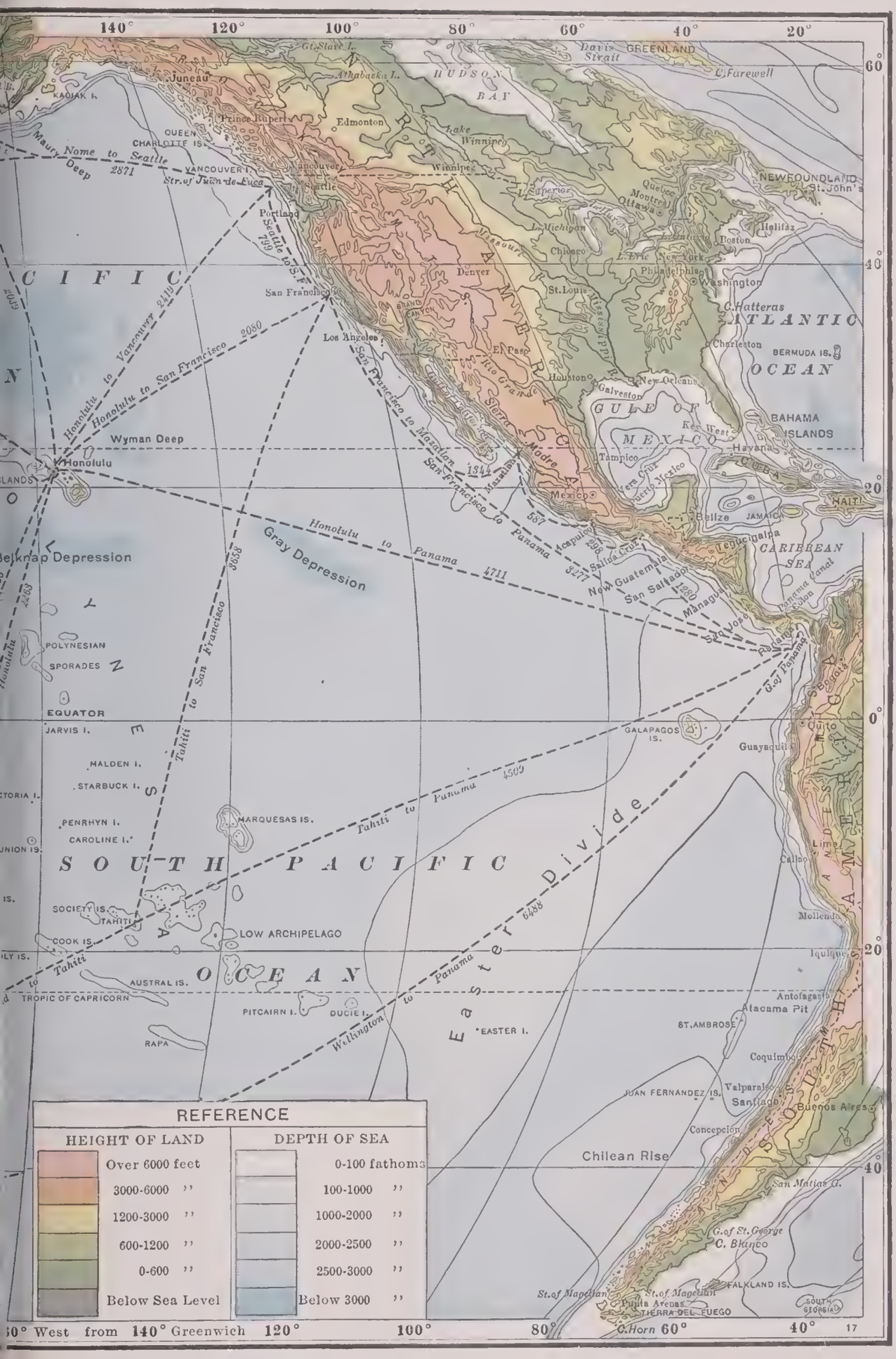

REFERENCE
HEIGHT OF LAND
Over 6000 feet
3000-6000 ''
1200-3000 ''
600-1200 ''
0-600 ''
Below Sea Level
DEPTH OF SEA
0-100 fathoms
100-1000 ''
1000-2000 ''
2000-2500 ''
2500-3000 ''
Below 3000 ''
60° West from 140° Greenwich
Gray Depression
Belknap Depression
Wyman Deep
Honolulu
Honolulu to Vancouver 2419
Honolulu to San Francisco 2080
Honolulu to Panama 4711
Tahiti to San Francisco 3658
Tahiti to Panama 4509
Wellington to Panama 6488
Easter Divide
Chilean Rise
SOUTH PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
NORTH AMERICA
SOUTH AMERICA
HUDSON BAY
GREENLAND
NEWFOUNDLAND
BAHAMA ISLANDS
BERMUDA IS.
Juneau
Prince Rupert
Edmonton
Vancouver
Seattle
Portland
San Francisco
Los Angeles
Denver
El Paso
Houston
Galveston
New Orleans
Chicago
St. Louis
Washington
Philadelphia
New York
Boston
Halifax
Ottawa
Montreal
Quebec
Winnipeg
Lake Winnipeg
Mexico
Tampico
Havana
Belize
Tegucigalpa
Managua
San Jose
Panama
Quito
Guayaquil
Lima
Callao
Mollendo
Iquique
Antofagasta
Atacama Pit
ST. AMBROSE
Coquimbo
Valparaiso
Santiago
Buenos Aires
Concepcion
JUAN FERNANDEZ IS.
San Matias G.
G. of St. George
C. Blanco
FALKLAND IS.
St. of Magellan
Punta Arenas
TIERRA DEL FUEGO
C. Horn
SOUTH GEORGIA
POLYNESIAN SPORADES
EQUATOR
JARVIS I.
MALDEN I.
STARBUCK I.
PENRHYN I.
CAROLINE I.
MARQUESAS IS.
SOCIETY IS.
TAHITI
COOK IS.
LOW ARCHIPELAGO
AUSTRAL IS.
TROPIC OF CAPRICORN
PITCAIRN I.
DUCIE I.
RAPA
EASTER I.
GALAPAGOS IS.
KADIAK I.
QUEEN CHARLOTTE IS.
VANCOUVER I.
Str. of Juan de Fuca
Maury Deep
Nome to Seattle 2871
Seattle to S.F. 799
San Francisco to Mazatlan 1344
San Francisco to Panama 3277
Mazatlan
Acapulco
Salina Cruz
New Guatemala
San Salvador
Panama Canal
Colon
G. of Panama
Sierra Madre
Rio Grande
Mississippi R.
Missouri R.
Hudson Strait
Davis Strait
C. Farewell
Athabaska L.
Gt. Slave L.
Lake Superior
L. Michigan
L. Huron
L. Erie
L. Ontario
Cuba
Haiti
Jamaica
Key West
Vera Cruz
Puerto Mexico
Bogota
Lima
Santiago
Concepcion
Valparaiso
Buenos Aires

The chief interest of the United States has, in the past, been one of naval strategy. To safeguard its western coast against possible attack from the sea, much faith has been placed in the so-called "quadrilateral of defense," formed in the Pacific by coaling stations and fortified harbors, which might serve as bases of operation in time of war. This quadrilateral is traced from San Francisco to Kiska Island in the Aleutians, then to Guam, then southwestward to Samoa, then back to San Francisco. In the center of this diamond-shaped area, and supporting each of the outlying positions, are the Hawaiian Islands. The value of this defense system, however, has been somewhat impaired by the fact that Japan's former German islands now completely encircle Guam.

PADEREWSKI (*pä-dĕ-rĕv'skē*), IGNACE JAN (born 1860). As musician and as statesman, Paderewski's place in history is unique. Long recognized as the world's greatest living pianist and as a composer of note, he was also an ardent Polish patriot and bitterly resented the great international crime by which, over a hundred years before, Prussia, Russia, and Austria had wiped Poland off the map and annexed its territories. So, when the World War of 1914–18 came, he closed his piano and directed all his magnetic energy to the task of restoring that vanished state.

PADEREWSKI
Pianist and Polish Premier

Paderewski was born of a noble family at Kurylowka, a little place in Russian Poland, and was educated in Warsaw, the former Polish capital. He began to play the piano at the age of 3, and when 17 years old he made his first concert tour. Later he became a pupil of Leschetizky, a famous Polish teacher of the piano in Vienna, and in 1889 appeared in concerts in Vienna and Paris, taking his audiences by storm. A series of triumphs in London and America was followed by the verdict that since Liszt no greater pianist had been known. He made the first of his many successful American tours in 1891.

Paderewski was always a great favorite in the United States. In 1900 he established the Paderewski fund, to be held as a permanent trust to aid musical education in the United States, prizes being offered every three years for the best musical composition submitted by American-born composers to a selected board of judges.

During the World War, Paderewski and his wife organized and supervised relief work for war-devastated Poland, and he directed the formation, equipment, and training of an American-Polish legion to fight on the side of the Allies. Largely through his efforts the Allies were led to declare in favor of the re-creation of "a united independent Polish state, with free access to the sea."

Returning to Warsaw, after the signing of the armistice, he was able to unite the radical and conservative elements in Poland in support of a representative form of government by all classes. He was made the first premier of Poland in January 1919, and presented the case of Poland to the Peace Conference in Paris, voicing and interpreting the political spirit of his countrymen as he had before interpreted the spirit of Poland in music. He retired from the premiership before the end of the year.

Paderewski's compositions include 'Manru', an opera produced in 1901, a suite for the orchestra, and numerous piano pieces.

PAGEANT (*păj'ănt*). The colorful community spectacles or "pageants," so frequently employed today to commemorate historic events and personages, are no older than the 20th century. They took their rise from the rebirth of the dramatic spirit in the last generation (*see* Drama). The pageant of the Middle Ages contained the germ from which the modern pageant was developed, but these old-time spectacles were only elaborate processions. They were like the modern pageant in that their aim was usually to recall the glorious events and personages of bygone days, but they were only in dumb show. There was no dialogue, little unity, and not much artistic appeal. Processions of this type were popular in the Middle Ages, and have survived to the present day in some of the ancient cities of Europe. In the United States this type of pageant exists in the Mardi Gras celebrations of New Orleans, the Festival of the Veiled Prophet in St. Louis, and the harvest and flower festivals held in many cities. But there is a wide gulf between these street parades and the dramatic pageant of today, for the latter has a carefully arranged plot and spoken dialogue, often of high literary merit, with special songs and accompanying music, and is historically accurate in its settings and costuming.

The famous spectacle given at Sherborne, England, in 1905, which owed its chief inspiration to an English playwright, Louis N. Parker, marks the beginning of modern pageantry. The idea took root at once, and within a few years dozens of similar spectacles were produced in England and the United States. At first, the only type was the pageant of local history, and this still remains the most popular and important variety. But the new dramatic form showed itself to be so vital that it has already given birth to such widely differing types as the masque, the civic festival, and the various school celebrations of such occasions as Christmas, Thanksgiving, Arbor Day, May Day, and the anniversaries of famous men and

events. Educators have been quick to see the tremendous power of such semi-dramatic productions in focusing interest on social and historical topics, so today one of the familiar features of college and school life is the pageant in its many forms. Often these productions, from start to finish, are the work of the students; they write the book and the music, and they design and make the costumes and scenery. Examples are the notable productions in 1916 to commemorate the 300th anniversary of Shakespeare's death.

DANCING IN A PAGEANT

Can't you feel the joyous spirit of spring in the very movement of this dance of the "Pipes of Pan" in a pageant of spring given by a group of college girls?

Whether the form be the historical pageant, the allegorical and symbolical masque, the civic festival, or the school play, the basic and essential idea in all is the expression of community spirit. As in the pageants and plays of the Middle Ages, the whole community is expected to take part in some way, either as performers, or in assisting in the work of production, or merely as spectators. In the words of William Chauncy Langdon, one of the notable figures in the development of the pageant in the United States, "The modern pageant is an instinctive expression in dramatic form of the new community spirit; and as there never before was such a community spirit in the history of the world, so there never was such an expression of it." This democratic art-form suits especially the character of the people of the United States, where the pageant has developed a depth of meaning, a variety of form, and an artistic completeness such as is found nowhere else.

Paine, Thomas (1737–1809). "Freedom has been hunted round the globe. Asia and Africa have long expelled her. Europe regards her like a stranger; and England has given her warning to depart. O, receive the fugitive and prepare in time an asylum for mankind!" This was the clarion call of Thomas Paine to the American colonists, published in his pamphlet 'Common Sense' in January 1776—a 50-page argument for independence that was at once hailed by multitudes as their unspoken thought. Thousands of copies were sold. Everybody of importance read it, and as Washington said, it turned the wavering scale of public opinion toward complete freedom from the mother country.

The man who rendered this signal service to the cause of the colonists was a poor English emigrant of Quaker parentage, who had arrived in America only 13 months before. Paine was a born agitator, and so erratic that living with him must have been a trial. After a meager education he wandered from one occupation to another. He went to sea, he tried manufacturing, and finally he became an exciseman, or collector of internal revenue taxes in England. But he neglected his duties and was dismissed.

Then it was, in 1774, that he came to America, armed with letters of introduction from Benjamin Franklin, who had befriended him abroad for the "genius in his eyes." Paine at once threw himself heart and soul into the cause of the colonists. He served in the Continental army for a short time; and amid the hardships and discouragements of the early years of the Revolution, when it seemed that all was lost, he began the publication of 'The Crisis', a series of 16 pamphlets which began with the words, "These are the times that try men's souls." This publication put new courage into the colonists. Washington ordered copies of it read to the army, and the opening words quoted above became an inspiring battle-cry.

Paine was rewarded by an official position under the Continental government, but he indiscreetly published information that he had gained in his official capacity and was forced to resign in 1779. After the close of the Revolution, Congress and the states of New York and Pennsylvania granted him money and land, which relieved him from the pinch of poverty.

He returned to Europe in 1787 with a model of an iron bridge which he had invented, and which was exhibited in Paris and in London. When the French Revolution broke out Paine became one of its English supporters. He wrote an able book called 'The Rights of Man', in reply to an attack on the Revolution published by Edmund Burke. Today Paine's book seems very moderate, but for publishing it he was indicted for treason and fled to France. There he was elected to a seat in the assembly called the Convention. Though he was a radical, Paine was not an extremist, and he opposed the execution of Louis XVI. This won for him the ill-will of the Jacobins, and he was saved from the guillotine only by the fall of Robespierre. After ten months in prison he was released.

Paine's inexcusable attack on President Washington, published soon after his release (1796), and his criticism of revealed religion in his notorious 'Age of Reason', lost him many of his old friends. He returned to America in 1802, after the cause of liberty seemed lost in France, but only a few now remembered his services to the cause of the colonies. Suffering from ill health, he wandered from place to place until his death in New York City in 1809.

For any subject not found in its alphabetical place see information

PAINTING, the QUEEN of the ARTS

A few strokes of the pencil in the hands of a master, and though we are looking at a flat surface, we see solid forms with length, breadth, and thickness. A few dabs of paint blending in harmony, and we are in the presence of sunlight or shadow; the soft green of a quiet meadow invites, or we are awed by the irrepressible force of the mighty sea; men and women stand before us, and we seem to see into their very souls. Thus the magic art of the painter conjures up forms of truth and beauty. Painting is older than writing; it was employed by primitive man when speech was too crude to express all he wished to say. We shall here make but a brief survey of its development from pre-historic times—of the changes it has undergone, of the possibilities it has revealed, and of some of the great and gifted men who have devoted their lives to this fascinating art.

PAINTING. The history of painting begins in the remote ages when man depended for his existence solely on his skill as a hunter. Among the men of the Old Stone Age, more than 20,000 years ago, there were painters who possessed the adroitness of hand and power of observation that enabled them to paint, with amazing fidelity and spirit, pictures of bison, horses, deer, and other animals. In the cave of Altamira in northern Spain we can still see their paintings of these animals, in three colors, executed with an assurance of line that would do credit to a modern draughtsman. Art expressions of almost equal merit drawn and engraved on bone and ivory have been found in caves of southern France. These carvings and incised drawings show the antelope and the horse, the mammoth and the reindeer.

When man had advanced a little farther in culture and learned to domesticate animals and raise crops, these naturalistic drawings disappeared. Perhaps it was because they were of a different race, perhaps because they were no longer dependent entirely upon the skill of hand and eye as hunters, that the men of the New Stone Age seem to have lost their interest and adroitness in drawing. Such rude attempts as we find to represent men and animals in this period were immeasurably inferior to those of the Old Stone Age. There seems to have been no redevelopment of the art of painting until the beginnings of the historic period, when men began to erect elaborate tombs and temples and decorate them with pictures.

The paintings of the ancient Egyptians consisted simply of outlines filled in with flat colors. They knew nothing about the rendering of depth, of light and shade. They tended to conventionalize the human form, drawing it with the shoulders in front view, the head in profile, and the eye full-face. This also was true of the archaic Greek method. Yet within their limits the Egyptians achieved remarkable success. Men and animals were depicted in characteristic attitudes, often with touches of humor, and every phase of life was shown on the walls of their tombs. In many of their paintings the colors—yellow, red, brown, blue, and green, harmoniously combined with black and white—still remain vivid.

While the art of painting was developing on these lines along the banks of the Nile, it also made considerable progress along the Tigris and Euphrates, where the Babylonians and Assyrians were learning to decorate the interior of their stucco-covered mud-brick walls with painted scenes, while they adorned the exterior with artistic glazed tiles. From the scanty fragments of their work that have survived we can see that they were inferior to the Egyptians in their attempts to represent the human figure, but far surpassed them in the vigor and spirit with which they represented animal figures.

In prehistoric Greece, Crete, and other Aegean lands, about 2,000 years before Christ, artists decorated vases in rich designs and painted the walls of palaces with animated scenes from the life of the time (*see* Aegean Civilization). The people who succeeded them, the Greeks of history, sweeping all this away, built up from rude beginnings a greater art of their own. We can trace an ever-growing feeling for design in the black and red vases that have come down from this time, but their great paintings have disappeared. We can, however, form some idea of their genius from the paintings on the buried walls of Herculaneum and Pompeii. (*See* Greek and Roman Art; Pompeii.)

The Art of the Early Christians

Early Christian painting, though influenced by the art of the ancients, shows a decided change in subject and spirit. The followers of the new faith, persecuted by the Roman Empire, sought refuge and a place of worship in the great underground cemeteries known as the catacombs. They decorated the dark walls with religious symbols and with pictures of Christ and the saints simply and crudely drawn. Later, when they were permitted to worship openly, they built churches and adorned the walls in a similar manner. Often mosaics took the place of the mural or wall paintings, and many of these more permanent works of art still remain, while the paintings have been destroyed (*see* Mosaic). Wrought out of tiny bits of marble and glass, they represent the personages of the sacred narratives as figures of epic grandeur.

With the barbarian invasions and downfall of the Roman Empire in the West there was a general decline of the arts, including painting. Byzantine art, which reached maturity in the 6th century and flourished in the 10th and the 12th centuries, profoundly affected early Christian art and gave an imported conventionalized splendor to the paintings and mosaics of Venice and other Italian cities (*see* Byzantine Empire).

In the 13th century, at the time that Gothic architecture (*see* Architecture) was flowering in France into "the most beautiful and complex architectural monuments the world has ever known," painting in Italy and elsewhere in western Europe was taking on a new form, abandoning the stiff conventionalism of the Byzantine and striving for realism—though touched with mysticism—in the handling of religious subjects. Gradually, too, the grace and harmony of Greek and Roman models made itself felt, preparing men's minds for the Renaissance (*see* Renaissance).

In Italy, Cimabue (died about 1302), of whom so little is known with certainty that he has become a half-legendary figure, paved the way for this great new birth; but it was his pupil, the Florentine Giotto (about 1267–1337), who definitely began the new era in painting. This great master drew his inspiration chiefly from nature, and impressed a whole century with his method of painting "like the life" (*see* Giotto). Among those who followed him was the monk of Fiesole (near Florence) called Fra Angelico because of his saintly life. He lacked the variety and breadth and freedom of Giotto, but his saints and angels have a delicate beauty of their own, and the work of no other painter is so filled with Christian devotion.

Arriving at the 15th century in Italy we find the most important epoch in the development of painting. Then it was that *perspective*, the art of representing

THE ART OF THE STONE AGE PEOPLE

These animals, the bison at the left and the galloping wild boar at the right, were painted in a cave of Altamira, Spain, by men of the Stone Age fully 20,000 years ago, perhaps as much as 50,000 years ago. Compare these figures of the bison and the boar with the work of the Egyptians on the next page. The rough cave-dwellers had a better touch, a better feeling for anatomy and motion than the cultured artists of the Nile who lived ages later.

objects as they actually appear in space—in three dimensions—was at last mastered (*see* Perspective). A great advance in truth to nature was made by the study of anatomy and of the nude form. At this time, too, the technique of oil painting was brought to new perfection.

Before this time Italian painters had produced their great wall paintings for church or palace by working in "fresco," or painting in water colors on the "fresh" plaster of the wall. As the painting of any particular part had to be completed while the plaster was still wet, the artist was obliged to work rapidly high up on scaffolds and often under great difficulties as to light and position. Fresco painting was the medium used by Leonardo da Vinci, Michelangelo, and Raphael for their great wall paintings even at the height of the Renaissance. "Tempera" or "distemper," in which the colors were fixed by some medium such as eggs or glue, and a process by which the colors were mixed with melted wax, were also used, especially for altar pieces and easel paintings on wood. Painting in "oil" —that is, with pigment ground in linseed or poppy oil—possesses great advantages over all other techniques and is now generally employed. Its discovery was formerly credited to the brothers Van Eyck of the Netherlands, in the early 15th century, but at most they merely made certain technical improvements. At almost the same time the new process spread rapidly in Italy and elsewhere, and gave a great impetus to the art of painting.

EGYPTIAN WALL PAINTING MORE THAN 3,000 YEARS OLD

This is part o a fresco from a Theban tomb, built during the 18th Dynasty, which flourished about 1500 B.C. At the right are two charioteers with their horses. In the lower group the horses are feeding while the driver rests. At the left is a man drinking water. The original is done in bright red, yellow, and green. The figures have the squareness and rigidity which is characteristic of ancient Egyptian art, and even the horses are formal and stiff in their motions.

One of the first to point the way towards the representation of the third dimension and of space as a whole was Tommaso Guidi (1402–1429), best known by his nickname Masaccio, which means "Slovenly Tom" and which was given to him because of the untidiness of his person. His work is full of truth and vigor, and many regard him as the real father of modern painting. Contemporary with and following Masaccio, who died in his 28th year, there was a great company of artists in Florence. Among them were Paolo Uccello (1397–1475), many of whose quaintly realistic pictures were studies in perspective; Fra Filippo Lippi (1406–1469), a monk, not wholly concerned with heavenly things, as we see from his charming but far from devotional paintings; Verrocchio, the teacher of Leonardo da Vinci, and a sculptor as well as a painter; Ghirlandajo (1449–1494), a master of monumental style in fresco; and Sandro Botticelli (1444–1510), who not only treated Christian subjects, but went back to the classic myths, which he painted with idyllic sentiment and beauty.

Other cities in Italy also raised great painters in this century. At Padua, Mantegna (1431–1506), influenced by the study of classic art, developed a rich and sculpturesque style of painting, which later powerfully influenced the art of Venice, especially through the Bellini brothers, Gentile and Giovanni. Perugia in Umbria produced another line of famous painters, inspired by the gentle beauty of the lovely Umbrian landscape. Chief of these was Perugino (1446–1524).

A BYZANTINE "PAINTING" MADE FROM BITS OF COLORED GLASS

Mosaics—pictures made by fitting together pieces of marble, colored glass, etc.—were the favorite decoration of the early Byzantine period. This celebrated mosaic, representing the Empress Theodora with the priests and ladies of the court, is believed to have been brought to Italy soon after it was finished—about the time of Justinian the Great. It is now preserved as you see it here in the Church of St. Vitale, Ravenna.

In the 16th century Florence gave to the world the two giants of the Renaissance, Leonardo da Vinci and Michelangelo. These two masters, as well as the divine Raphael and the brilliant Venetian colorist Titian, who are counted as the other members of the "quartet of world-masters of painting," are treated in separate articles. Andrea del Sarto (1486–1531), called "the faultless painter" by his fellow-citizens in Florence, painted pictures of the Madonna almost as beautiful as those of Raphael, but lacking in spiritual elevation. Antonio Allegri of Parma, known as Correggio (1494–1534), was inspired by both Leonardo and Michelangelo, though he was of very different temperament from either. He treated pagan myths and Christian themes alike with soft sensuous beauty and grace. Associated with Titian were Giorgione (1478–1510), noted for his glowing color and magical flesh tints, Tintoretto (1518–1594), who sought to emulate "the drawing of Michelangelo, the coloring of Titian," and was fond of grand effects and violent contrasts in light and shade; and Paul Veronese (1528–1588), whose work perhaps best expresses the splendor of Venetian life.

Meanwhile a strong and independent art had been developing in Holland and Flanders. Hubert and Jan Van Eyck headed the Flemish school of the 14th and early 15th centuries. Not only were they great portraitists, but they were the first painters of landscape, replacing the gold background of the medieval panel by a setting of natural scenery, truthfully represented in form and distance. The painters who followed them in Germany often sacrificed beauty in striving for realism in details. But in the first half of the 16th century Germany could boast of two artists, Albrecht Dürer and Hans Holbein, who are among the great geniuses in the history of art (*see* Dürer, Albrecht; Holbein, Hans). In Flanders Van der Weyden, Memling, and Quentin Matsys continued the realistic style of the Van Eycks, but the next generation of Flemish painters studied in Italy and imported the Italian methods. As a whole these so-called "Italianizers" failed to produce great art, but out of their ranks came the mighty Rubens, who, without losing his own individuality, brought into his work the richness and fullness of Venetian art (*see* Rubens, Peter Paul).

HOW THE 14TH CENTURY ITALIAN MASTERS PAINTED

This fresco of Christ washing the feet of the Twelve Apostles was painted by Giotto in the Arena Chapel at Padua. It is typical of the best in early Italian art. Simplicity, dignity, and dramatic power are there in abundance, together with a lifelike rendering of faces and a broad and natural treatment of draperies. Perspective, however, has not yet been mastered, and we still see the old formalism which demanded that saints be represented with halos.

In the 17th century in Holland and Flanders there came a new democratic expression. Then it was that the "Dutch Little Masters," as they are sometimes called, raised *genre*, or the painting of common life, to the level of a great art. The artist had learned that beauty may be found anywhere. His trained vision found it in the courts of kings, the sordid market-corner, the meadow or the barnyard, when the magical effects of light or color touched his subject. It was Rembrandt (1606–1650) who first proved conclusively this principle of modern painting. He revealed that it was appearance that was important and not reality. He and the Spaniard Velasquez (1599–1660) are accounted among the greatest of the world's painters who subordinated details to the impression of the whole (*see* Rembrandt; Velasquez). Ranking not far below Rembrandt as portrait painters were the jovial Frans Hals of Haarlem, and Van Dyck of Antwerp. The latter founded the English school of portrait painting and left an incomparable gallery of historical portraits. Ver Meer of Delft and Jan Steen are among the other noted members of the Dutch school. In Spain Velasquez was followed by Murillo, a less powerful but very charming painter (*see* Murillo).

Landscape painting became highly developed for the first time in the 17th century. Earlier artists had regarded landscape as incidental to the figure or the story of the picture; now it became the picture. The Dutch painters Jacob Ruysdael (1628?–1682), Hobbema, and Cuyp were among the first to show how a faithful representation of natural scenes might be raised to high art expression. In France under the leadership of Claude Lorrain (1600–1682) there developed what is known as "classical landscape," in which very beautiful but more artificial and conventional effects were produced.

In the 18th century England assumed a prominent place in the world of painting. Hogarth (1697–1764), the first representative English painter, painted the life of his time with a satiric touch and made many of his pictures, such as 'The Rake's Progress', teach a moral lesson. There is a story interest in all his work, which made Charles Lamb say: "You look at other pictures, but *read* Hogarth's." Sir Joshua Reynolds (1723–1764), who portrayed so well the charm and innocence of childhood as well as the fashionable men and women of his time, and his rivals Gainsborough (1727–1788) and Romney (1734–1802), were the artistic successors of Van Dyck.

Painting in the Nineteenth Century

The great English landscape artists Constable (1776–1837), who replaces the somber browns of the Dutch landscapists by the vivid tints of nature, and J. M. W. Turner (1775–1851), "the greatest magician of light who ever wielded a brush" (*see* Turner), bring us into the full swing of the 19th century. Here we

A FINE EXAMPLE OF 19TH CENTURY IMPRESSIONISM

Between the work of Giotto on the preceding page and this painting by the Spanish impressionist Sorolla, the whole history of art has unfolded. That history you may find summed up in the "Picture Gallery" at the end of this article. This canvas, called 'Hitching Oxen to the Boat' shows the brilliant sunlight effects which made Sorolla famous. Impressionism puts its entire emphasis on rendering the effects of light, giving only enough detail to mold the figures. It is essentially a school of the out-of-doors.

find a vast increase in the number of painters. Where before there was one painter, there were now dozens, and a number of important schools, or at least community groups, were created. The first was the Barbizon group in France, named from a village in the Forest of Fontainebleau near Paris. Here Theodore Rousseau retired to live close to nature, and he drew after him Millet, the great painter of French peasant life, Daubigny, Diaz, Dupré, and others. Their aim is expressed in the words of Rousseau: "Let us try in our works to make the manifestation of life our first thought; let us make a man breathe, a tree really vegetate." Corot, the exquisite painter of Nature in her more tranquil moods, is usually included in this group. There were at this time also a number of gifted animal painters, among them Troyon and Rosa Bonheur. (*See* Bonheur; Corot; Millet.)

In England a few years later came the Pre-Raphaelite movement which owed its inspiration largely to Ford Madox Brown. He did not become, however, a member of the "Pre-Raphaelite Brotherhood" formed in 1848 by the youthful painters Dante Gabriel Rossetti, Holman Hunt, and Millais. "Let us get back to life again," was their motto; "let us have something to say; let us shirk no detail; let us be sincere." They aimed to attain the "directness, honesty, and inspiration which they discerned in the painters before Raphael." Their scrupulous fidelity to detail is illustrated by the story that Hunt went to the Holy Land to obtain local color for his picture 'The Shadow of the Cross', picturing Jesus at work in his home as a carpenter. When the painting was completed, a friend in England suggested that the shavings on the floor were from the wrong kind of a tree and the painter made the trip to Palestine again to make sure which particular sort of cedar Our Lord would have worked on. Sir Edward Burne-Jones, as a pupil of Rossetti, was associated with this group, and G. F. Watts, known by his portraits of Tennyson and Browning and his beautiful allegorical pictures, was inspired by similar ideas. Lord Frederick Leighton (1830–1896) of England and Sir Lawrence Alma-Tadema (1836–1912), a Hollander, who became an English citizen, chose ancient Greek subjects.

But there was to come soon a new viewpoint in the expression of painting. In the early 1860's in France, a group of painters were stirred to rebel against classic traditions and strike out along a new line. The name "impressionists," which soon attached itself to this school, indicates their fundamental purpose, which is to paint the immediate impression the artist receives from objects in nature. They aim especially at the truthful rendition of the effects of light, using only the pure colors of the spectrum. They avoid sharp modeling of objects, excluding all unnecessary detail, with the result that close by their pictures seem mere rough patches of colors and have to be viewed from a distance to give the desired effect. Their work at first was ridiculed, but today the whole range of painted art shows traces of impressionist influence. The father of this school was Edouard Manet (1833–1883), and his chief followers were Claude Monet, Dégas, Pissaro, and Renoir. In England the American James McNeill Whistler was the chief exponent of impressionism. In Spain it won over two of the greatest of modern painters, Sorolla and Zuloaga.

Out of the impressionist movement was born shortly before the World War the still more revolutionary "post-impressionism," which represents a violent reaction against all the older theories and practices of painting. The followers of this school no longer attempt to paint nature, but seek to express feeling through form and color. As Roger Fry, one of the important English painters associated with the movement, says: "The post-impressionists do not seek to paint form but to create form; not to imitate life, but to find an equivalent for life. They wish to make images which, by the clearness of the logical structure and by their closely knit unity of texture, shall appeal to our disinterested and contemplative imagination with the same vividness that the things of actual life appeal to our practical activities." One group of these radicals, who call themselves "cubists," obtain their effects by painting only in geometrical forms and lines. Another group, the "futurists," make intensity and force their primary aims.

Most of the world laughed over the weird canvases which were exhibited throughout Europe and America. Whatever the significance and value of these daring experiments may be, some really impressive paintings have been produced in these later styles, especially by certain English war artists who used the cubist

THE BIZARRE EFFECTS OF 20TH CENTURY CUBISM

What jumble is this? What sense to these garbled lines? But wait a minute! The Cubists have gone several steps beyond the Impressionists. They have sacrificed even form to movement. This painting by G. R. G. Nevinson is called 'Returning to the Trenches'. As you look at it at arm's length, can't you "feel" the confused regularity of marching men? See the rifles all pointing at the same angle, and the suggestion of measured rhythmical tramping in the lines at the lower left-hand corner. Remember, the Cubists, with their arrangements of lines and planes, are trying to depict transitory sensations as they pass over our minds. They are not trying to present definite pictures.

formula to portray bodies of troops in action. Some of the best known names associated with these ultra-modern tendencies are Cézanne, Gauguin, and Matisse in France; Picasso in Spain; Augustus John and Roger Fry in England; Arthur Dove and Arthur Davies in the United States.

Painters of the United States

The United States has not yet produced a distinctive native art. It has, however, produced many painters of great talents and a few whose names will live. American painting had its birth with Benjamin West (1738–1820), who in the light of present standards might not be considered a great artist, but who had the ability to make himself a necessary adviser to King George III of England, and who was the real instigator of the founding of the Royal Academy in London in 1767, and later became its president. West passed his boyhood in Philadelphia, when the Indians lived just on the outskirts of that city, and they gave him the material he used for 'The Death of General Wolfe'. He painted a large number of historical and religious pictures and one of his best known canvases is 'Death on the White Horse' in the Pennsylvania Academy of Fine Arts in Philadelphia.

While West was an American painter by birth, most of his life was passed in England; but John Singleton Copley (1737–1815) was a true American and there are in existence today many of his portraits. Charles Wilson Peale (1741–1827), whose portrait of Washington is probably his best known picture, and John Trumbull (1756–1843) were the next American painters to win distinction in the times just preceding the Revolution and the early days of the new republic. Gilbert Stuart (1755–1828) is chiefly remembered for his 'Athenaeum Portrait of Washington', the best known and most popular of all the pictures of Washington. It is in the Museum of Fine Arts, Boston.

Thomas Sully (1783–1872) was born in England, but as most of his life was passed in America has been classed with the Americans. His portraits were of uneven quality, but there are some of such surprising beauty that it would be well for his artistic reputation if only the good ones were left.

Early in the 19th century America developed a group of painters known as the Hudson River School, of which Thomas Cole (1801–1848) was a leader. He found the beauty of American landscape for many who had never before discovered it. Turner said of him, "He is as much a poet as a painter." Thomas Doughty, Frederick E. Church, and Emanuel Leutze, who painted the well-known picture of 'Washington Crossing the Delaware', are other names connected with the Hudson River School. William Morris Hunt (1824–1879) studied under Millet and brought the influence of the Barbizon school to America.

George Inness (1825–1894) was America's first great landscape painter and many consider him one of the world's great painters. It has been said of him: "The power of touching the mystery of familiar things was one of Inness' strong points. There lingers in and around his landscapes that human warmth which makes the world akin."

Among other distinguished American landscape painters of the later 19th century were Homer Martin (1836–97), who was gifted with the ability to express much through a few simple details, and Alexander H. Wyant (1836–92), who painted most of his delicately beautiful pictures with his left hand after he had lost the use of his right. Blakelock, Tryon, Carleton Wiggins, and C. M. Dewey have also given beautiful and characteristic interpretations of nature.

One of the outstanding figures in American art at the opening of the present century was Winslow Homer (1836–1910), painter of the sea and of seamen and fisherfolk.

John La Farge (1835–1910), an artist of large vision and wide influence, is best known as a mural painter, as are also Edwin Blashfield, Kenyon Cox, and Edwin Abbey, the last well known for his beautiful decorations in the Boston Public Library.

James McNeill Whistler (1834–1903) might be considered the greatest genius in the history of American art, but though born in the United States he passed most of his life abroad. The public laughed at his eccentricities and his theories of art, but his portrait of his mother has been accepted by the world as the type of true motherhood, and his numerous etchings are among the world's greatest. John Singer Sargent was born abroad of American parents, and he, like Whistler, has spent most of his life in Europe. His influence on American portrait painting has, however, been very great. His best known work is his splendid 'Frieze of the Prophets', on the walls of the Boston Public Library, but that represents only one side of this versatile genius. William M. Chase is another distinctive American portrait-painter. His portraits of his daughters, 'Alice' and 'Dorothy', are the kind one never forgets. John W. Alexander has many fine portraits to his credit, as well as such fanciful subjects as 'Isabella and the Pot of Basil'. Gari Melchers, one of the most virile painters of the day, is a sympathetic depicter of sturdy peasant types.

Painters of Adventure

Where many American artists have painted the beauties of the natural landscape, Jonas Lie in his New York and Panama Canal pictures has perhaps best depicted the power of man to overcome great natural obstacles. Robert Henri, George Bellows, and George Luks have shown other aspects of New York life. The vanishing life of the western cowboy is fixed on the canvases of Frederic Remington; while E. Irving Couse tells the story of the Indian.

Alexander Harrison and Theodore Robinson were among the first American painters to represent light and air according to the impressionist formula. Others are Childe Hassam, John H. Twachtman, J. Alden Weir, and Thomas W. Dewing.

Illustration has been raised to a high plane by Elihu Vedder, Howard Pyle, and Maxfield Parrish. (*See also* Fine Arts.)

The world-famous 'Sistine Madonna', by Raphael, fittingly introduces this series of masterpieces, in which you will find represented most of the principal periods or schools into which the history of modern painting falls. In the Royal Gallery, at Dresden, Germany, where this wonderful painting is given a separate room to itself, the babel of tourists is suddenly hushed when they come face to face with this masterpiece of the ages.

contained in the Easy Reference Fact-Index at the end of this work

FAMOUS PORTRAITS BY FOUR MASTERS

Here you see portraits by the greatest portrait painters of England, Germany, Holland, and Spain. The portrait of Mrs. Siddons (upper left) is by Thomas Gainsborough; Erasmus by Holbein (upper right); William of Orange and Mary (lower left) by Van Dyck; Don Balthasar Carlos, eldest son of Philip IV of Spain, by Velasquez. In Gainsborough we may recognize what is typical of the best English school, a certain refined idealism. In Holbein we see the delicate painstaking work of the German under the influence of the Italians, and a fidelity to his model that has rarely been surpassed. The Flemish realism of Van Dyck is tempered by nobility of expression. Velasquez is the "naturalist" who painted "what he saw"—master of light and atmosphere.

For any subject not found in its alphabetical place see information

LANDSCAPE PAINTING—A COMPARATIVELY RECENT ART

The world-famous 'Avenue of Middleharnis', by Meindert Hobbema (1638–1709), is a supreme example of the truth with which the Dutch landscape painters of the 17th century rendered nature. They were the first fully to master aerial perspective.

'Autumn Oaks', by George Inness, the American painter, shows poetic feeling and fine tonal effects. See how impressionism has done its work since the days of Hobbema's solid earth and trees.

contained in the Easy Reference Fact-Index at the end of this work

PAINTERS OF IDEAS AND EMOTIONS

The Pre-Raphaelites in England sought to get away from the false classicism of the early 19th century, back to the simplicity, sincerity, and religious feeling of the painters before Raphael. This painting, 'The Mill', by Sir Edward Burne-Jones, is typical of their work.

The French Romanticists, like the Pre-Raphaelites, were in revolt against pseudo-classicism, and each of their paintings expresses a mood or sentiment of the painter. Their desire for simplicity led them directly to nature, to paint peasants and cattle, fields, orchards, and woodland. This painting, 'The Angelus', by Millet, has been made familiar the world over by countless reproductions.

For any subject not found in its alphabetical place see information

A MASTER PAINTER'S TRIBUTE TO HIS MOTHER

Rembrandt was not merely the greatest master of the Dutch school but is regarded by many critics as the greatest painter of all time. More than any other painter he depicts the inner life of his subjects. He has well been called the painter of the soul. He is a dreamer, painter of things unseen. But he is also a masterly technician, and his command of high lights and intense shadows is unrivaled. Rembrandt is the poet among painters. In this painting, which is now in a Vienna gallery, the loving son has left a monument to his mother. An unaffected face, free from guile, seamed by years of hard toil, a firm mouth and chin spelling a strong character, relieved by a kindly eye and by the feminine touch of a clean linen cap and starched collar—this is a portrait of which any mother might well be proud.

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THE ART OF "COMPOSING" GROUP PICTURES

'The Banquet of the Arquebusiers', by Frans Hals (above), and the 'Dedication of Decius Mus' to the spirits of the dead, by Peter Paul Rubens (below) are striking examples of excellent grouping of figures on a canvas. More than any other quality, this art of composition determines the "striking" effect of a canvas.

For any subject not found in its alphabetical place see information

A STUDY IN CONTRASTS—CLASSICAL AND ROMANTIC

This painting by Paolo Veronese, with its wealth of detail, depicts in the classical Italian style the family of the slain Persian king Darius at the feet of Alexander, the conqueror.

'The Old Shepherd's Chief Mourner', by Sir Edwin Landseer, tells its story with only the simplest details. It shows the romantic quality which has made Landseer's work so popular in its appeal—the endowment of animals with human sentiments.

contained in the Easy Reference Fact-Index at the end of this work

Paints and Varnishes. Without the protection of paint, the great achievements of modern building and engineering would be impossible. The gray battleship, bulking big on the horizon, is the picture of grim power. The mighty bridge which throws its slender network of steel across the abyss shows scarcely a tremor as the heavy locomotive thunders over it. But the power of the battleship and the staunchness of the bridge would be fleeting indeed were they not protected from corrosion and rust by that seemingly insignificant thing—paint. Frame buildings would quickly mold and rot, radiators and boilers would rust and leak, but for paint. We also owe much to paint for its decorative value, adorning man's handiwork with bright colors, and for the service it performs in aiding proper interior illumination by lightening dark surfaces.

Paint is a mixture which contains a coloring matter called a "pigment" suspended in a liquid called a "vehicle," in which the pigment does not dissolve. There are two classes of paints: *oil paints*, in which oil is used as the vehicle, and *water-colors*, which are made with water. The only difference between artists' paints and ordinary building paints is in the quality of the materials used, and the care with which they are combined.

In commercial painting, water paints are used in the form of calcimine to cover wood and plaster, where little protection is needed. These are prepared by mixing slaked lime or whiting (manufactured from imported English chalk) and coloring matter with water containing glue or casein. The glue and casein give the mixture body and hold the pigments to the surface coated.

Extensive Use of Oil Paints

By far the greater proportion of painting is done with oil paints. The best paint is prepared by mixing linseed oil with white lead (carbonate of lead), or zinc white (oxide of zinc), and the coloring pigments needed to produce the desired color. Usually a "thinner" is added to dilute the mixture, and a "drier" to make it dry more quickly and to form a film of hard waterproof substance on the surface. Linseed oil, which is obtained from flaxseed by pressure, is the best of all vehicles, since it has the special quality of drying with a hard waterproof surface. The only other important "fixed oil," as such oils are called, is poppyseed oil, but this is far too expensive to be used in building paints.

Because of the cost of linseed oil and white lead, most of the prepared paints put up ready for use contain other oils, and inert substances known as "fillers." Soy-bean oil is extensively used to replace part of the linseed oil. "Fillers" or "extenders" are such substances as silex, clay, gypsum, and barytes (barium sulphate). They are not to be considered as adulterants or substitutes, for they serve to modify pigments too light or too bulky, too powerful in tone or too expensive, to be used alone. Because of their relatively coarse grain they take hold of the surface of the wood and prevent the paint from spreading. Fewer coats are thus needed.

White lead, the most important of paint bases or "body pigments," is prepared by several different processes, but the greatest amount is produced by the old "Dutch process," which gives the best quality. Lead in thin sheets is rolled up and put into earthen vessels with weak vinegar. Around these vessels is some such material as tan-bark, which ferments easily, producing heat and giving off carbon dioxide. After about six weeks the lead is either thickly coated with or entirely changed into white carbonate of lead. There are about forty white lead factories in the United States, the lead used being obtained from the Rocky Mountains.

Turpentine is the "thinner" generally employed. But the scarcity and high price of this material have spurred the chemists to find similar substances which are cheaper and nearly as effective. Most of these are distilled from petroleum and coal-tar. Benzine acts both as a thinner and a drier and is commonly found in ready-mixed paints. There are also several patent driers. A common oxide of lead known as "red lead" or "litharge," sugar of lead, and sulphate of zinc are often used, mixed with linseed oil and resin and reduced with benzine or turpentine.

Where Paints Get Their Color

For coloring pigments, metals, various kinds of earth, coal-tar products, and prepared bone are used. For example, lamp-black, bone-black, and graphite all produce black; sulphide of mercury gives vermilion, and cobalt gives blue. Chromate of lead and yellow ocher are used for yellow paints. Green is obtained from the salts of arsenic and copper—for example, "paris green"—and by mixing blues and yellows. Such vegetable and animal pigments as madder, indigo, and cochineal are too expensive to be used in building paints.

Until 1860 there were no machine-mixed paints, but most of those used today are machine-ground and prepared in factories. The base, usually white lead, is dumped into the mixers and linseed oil is added. This is mixed thoroughly and the color pigment put in. Then the mixture is run through a grinding machine, consisting of two huge grindstones fitted closely one upon the other and revolving slowly in opposite directions, with a pressure of several tons. Between the surfaces of these stones the pigment is ground in the oil to microscopic fineness. Zinc white is added to bind the constituents together and to keep the pigments from separating, a thinner is added, and if desired a drier, and the paint is ready for the can.

To give a durable and even surface several coats of paint are usually required. The first coat, called the "primer" or "priming coat" (from the Latin *primus*, meaning "first") is a thin coat of white lead or red lead, and driers mixed with linseed oil and turpentine. The flat finishes so much used for interior work are obtained by using lithopone, which consists

of barytes, zinc sulphide, and zinc white, mixed with turpentine. The very hard glossy finishes of the enamel paints are produced by adding varnish to the paint.

Iron and steel work is usually painted before the separate parts leave the manufacturing works, and several additional coats are put on after erection. The best paints for external iron work are made of oxide of iron and red lead, or graphite, mixed with linseed oil. The former gives the familiar orange hue of structural iron in process of erection.

A varnish is a thick sticky liquid, containing resins, gums, waxes, in solution. It is like paint in drying with a hard waterproof surface, but differs in that it is more lustrous and usually transparent or translucent. Spirit varnishes use methylated spirit (denatured alcohol), turpentine, or some other volatile liquid as a solvent. Oil varnishes, the most expensive and durable type, are made from drying oils such as linseed oil and china wood oil or tung oil (made from the nuts of various trees), thinned with turpentine. Common rosin or pine resin is used to a certain extent in varnishes, but the better and more durable varieties are made from such imported gums and resins as shellac, mastic, copal, kauri, dammar, and amber (*see* Gums; Lacquer-Ware; Resins).

Stains, which are merely dyes applied to wood, change the color of the wood but dry without a surface, thus leaving the grain visible. Furniture and interior woodwork are generally stained and varnished or waxed. When the wood is porous, like oak and chestnut, it must first receive a coat of "filler" to fill the pores. The stain is often mixed with the filler.

THE HOLY LAND *of Christians, Jews, and Mohammedans*

Extent.—North to south, 140 miles; east to west, from 35 to 110 miles. Total area, about 15,000 square miles. Area of Western Palestine, under British mandate, about 9,000 square miles; population, about 650,000 (515,000 Mohammedans, 65,000 Jews, 62,000 Christians).

Physical Features.—Jordan River rising on Mt. Hermon (9,100 feet), and flowing south through a low, narrow valley to the Dead Sea (1,300 feet below sea level). Rugged plateau rising to the east; broken mountain ranges (Mt. Carmel, Mt. Gilboa, Mt. Ephraim, etc.) stretching south from Mt. Lebanon between the Jordan and the Mediterranean Sea on the west. Sea of Galilee, 682 feet below sea level.

Products.—Wheat, barley, corn, tobacco, peas, and other vegetables; grapes, oranges, peaches, and nuts; olives and olive oil; silk; sheep, goats, camels; milk, butter, cheese, and wool; salt, asphalt, petroleum; soap.

Chief Cities.—Jerusalem (about 60,000), Jaffa (54,000), Gaza (35,000), Nablus (Shechem) (28,000), Hebron, Haifa, Bethlehem, Nazareth, Safed, and Acre.

PALESTINE. It was a glorious event when on December 11, 1917, quietly and unostentatiously, without pomp or blare of trumpet, General Edmund Allenby, commander-in-chief of the Allied armies in the East, entered the city of Jerusalem and delivered Palestine from the tyranny of the Turks. Under their oppressive rule the people had suffered for centuries, and the once beautiful and fertile land had become barren and desolate. For ages the hearts of half the world had turned with devotion and longing toward this land of Canaan, which was the Promised Land of the Israelites and the birthplace of Christianity. By Jew, Christian, and Mohammedan alike it is reverenced as the Holy Land.

No other country has so many shrines as Palestine, and few other lands have seen more stirring events. Yet Palestine is a tiny country, occupying only a small part of Syria, and little larger than the state of New Jersey.

As one stands on the top of Mount Ebal—which with Mount Gerizim opposite guards the ancient city of Shechem (now Nablus)—and lets his eye sweep over the landscape, he can view almost the whole of Palestine. To the west you see the deep blue waters of the Mediterranean, bordered by gleaming sand hills; to the east the Jordan River and—far to the north, beyond the boundaries of ancient Israel—snow-crowned Mount Hermon; while to the south you look upon Jerusalem on its height, and beyond to the southernmost hills of Judea skirting the wilderness.

Some of the more energetic travelers from the West cross the entire country on foot in a single day. Leaving the Mediterranean port of Jaffa, the traveler passes through beautiful orange groves and then across the flat plains of Sharon. Here in ancient times dwelt the Philistines, from whom the entire country was called Palestine, or the land of the Philistines (*see* Philistines). In wheat fields, bright with scarlet poppies, farmers may be seen plowing in much the same primitive fashion as in Bible times; while farther along, on the hillsides, Arab shepherds clad in their long robes and turbans still watch their flocks as did the Israelites in ancient days.

It is when we approach the cities that we realize what changes have taken place in the Holy Land. Jerusalem is still imposing from a distance, but when we reach it we find it bereft of all its ancient glories (*see* Jerusalem).

From the Holy City a rough and precipitous road leads down to Jericho, which lies nearly a quarter of a mile below the level of the sea. Jericho was the first city which the Israelites conquered when they entered the Promised Land, many centuries before the birth of Christ, and it was already a city noted for its wealth and luxury. It was rebuilt by the Romans and made so splendid that Antony chose it as a gift to present to his beloved Cleopatra. Now only a wretched village, consisting of a few squalid huts, marks the site of that famous "City of Palms." Even its natural beauty has suffered, for the palm trees have almost entirely disappeared.

A few miles farther and we are at the banks of the river Jordan, which we find thronged with Christian pilgrims who have come to bathe in the muddy turbulent waters of this historic stream. Each sect

ON THE BANKS OF THE SACRED RIVER JORDAN

This is the stream in which Christ was baptized by John the Baptist. Today guides conduct travelers through this region. The river is so quiet because of its nearness to the Dead Sea, whose salty waters back into it. There are no fish in the river. The climate and the vegetation are much like those of Florida.

has a different bathing place, which each claims to be the exact spot where Jesus was baptized by John the Baptist. Tarfa-trees, willows, and tall poplars, luxuriant thickets of myrtle, oleander, and other shrubs, clothe the banks here; but as we follow the swift stream southward to the Dead Sea the vegetation takes on a sickly look.

Occupying the lowest part of that great chasm through which the Jordan flows, the Dead Sea is almost 1,300 feet below the surface of the Mediterranean. Its water is five times as salty as that of the ocean. If we try to swim in it we cannot possibly sink, but bob up and down like a cork. This extreme saltiness is due largely to the rapid evaporation caused by the intense heat. Each of the many streams that flow into it brings a small amount of salt, which remains, while the water passes off as vapor. The Dead Sea deserves its name, for it contains no animal life except of the lowest, and fish put into its waters soon die. Such scanty vegetation as is found on the shores is covered with a white salt crust that makes it look as though "it had been smitten with leprosy." Yet seen from a distance the water appears brilliantly blue and clear. On the east and the west are tall cliffs, white or tawny or almost red in color, that glow in the light of the sunset like amethyst.

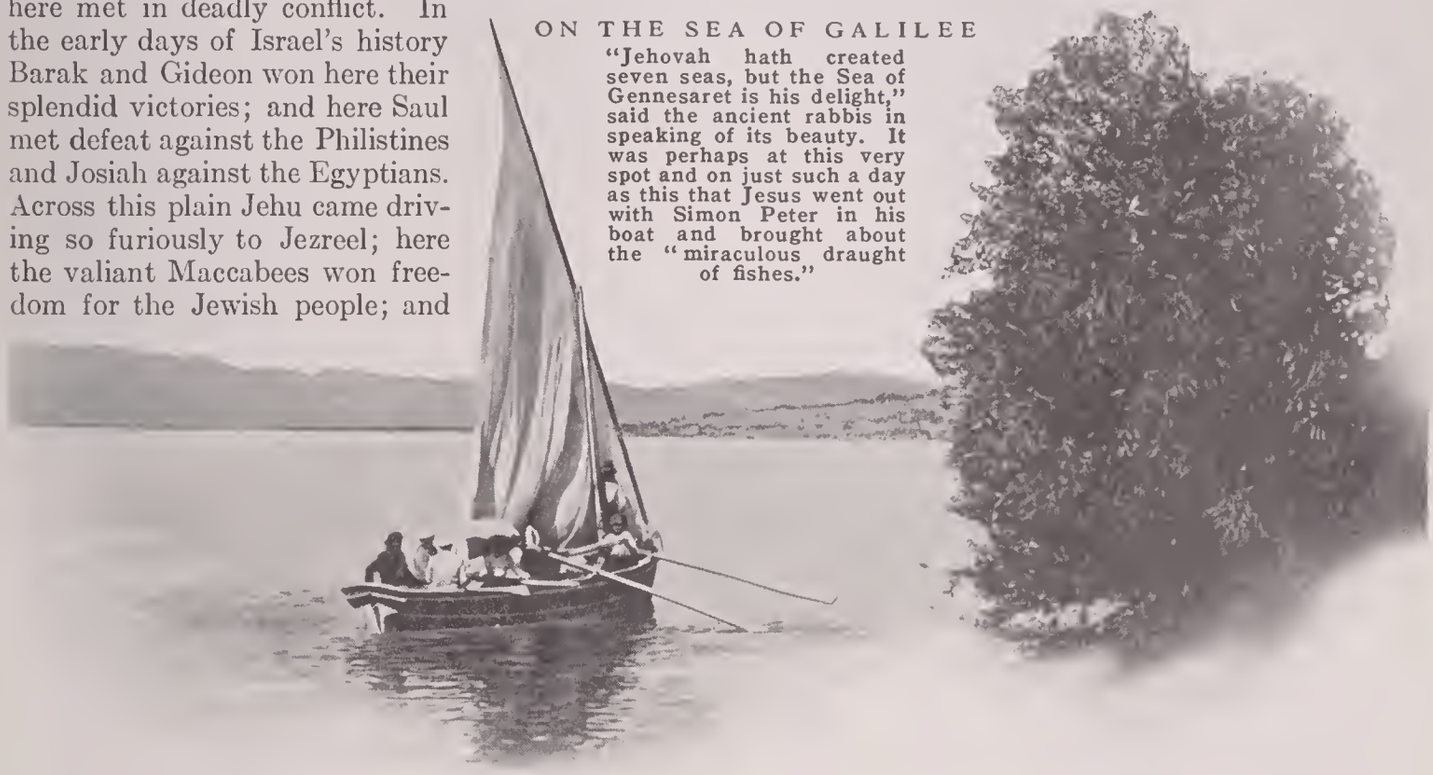
A SAMARITAN READING THE LAW

Only a few families remain in Palestine today to represent the ancient Samaritan people. They recognize only the Pentateuch (the first five books of the Bible) as sacred and claim that the orthodox Jews have departed from the pure Mosaic teachings.

Climbing back over the barren hills of Judea, we reach Bethlehem, where Jesus was born (*see* Bethlehem). A few miles farther south, in the ancient city of Hebron, is the cave where Abraham, Isaac, and Jacob are supposed to lie buried. About this place has been built a Moslem mosque, for the Mohammedans regard great patriarchs with reverence equal to that of the Jew or Christian.

Passing to the north we cross Samaria and reach the fertile, well-watered, and pleasant land of Galilee. Here, nestling among the hills, we find the town of Nazareth, where Jesus spent his boyhood. Looking out to the east from one of these hills, as he must often have done, we see across the Jordan the heights

of Gilead, with their forests of oak and terebinth or chian turpentine trees. To the south is the famous Plain of Esdraelon, the vast arena in which so many battles have taken place. Armies from the great empires of the Nile and of the Euphrates, from the north and the south, from the east and the west, have here met in deadly conflict. In the early days of Israel's history Barak and Gideon won here their splendid victories; and here Saul met defeat against the Philistines and Josiah against the Egyptians. Across this plain Jehu came driving so furiously to Jezreel; here the valiant Maccabees won freedom for the Jewish people; and in the Middle Ages many a Crusader died in the Plain of Esdraelon fighting for the cross. Napoleon's advance from Egypt was here checked by the Turks and British, and after three months' fighting he was forced back in the first great retreat of his career. In the World War of 1914–18 the Allies won Palestine from the Turks in this field; and it is supposed to be the Plain of Armageddon to which the Book of Revelations refers as the place where "the kings of the earth and of the whole world" are to gather for "the battle of the great Day of God Almighty," the Day of Judgment.



ON THE SEA OF GALILEE

"Jehovah hath created seven seas, but the Sea of Gennesaret is his delight," said the ancient rabbis in speaking of its beauty. It was perhaps at this very spot and on just such a day as this that Jesus went out with Simon Peter in his boat and brought about the "miraculous draught of fishes."

Along the Sea of Galilee

How peaceful after these scenes of strife seem the calm blue waters of the Sea of Galilee (Lake of Gennesaret)! On these shores Jesus often walked, and here he met the fishermen who became his apostles. Now the region is quieter than it was in his day. Only a few scattered boats are seen on the waters, which were once covered with sails; the ring of cities whose stately buildings were reflected in its waters have fallen, leaving only heaps of ruins. Even the fishermen have almost disappeared. The surrounding hillsides, once clothed with woods, are almost treeless now; and where there were beautiful gardens, almost down to the water's edge, there are now only marshes. But the lake has not lost its serene beauty, that led the rabbis to say of it, "Jehovah hath created seven seas, but the Sea of Gennesaret is his delight." Its waters are drained southward through the Jordan into the Dead Sea.

In material things Palestine is a poor country. Its natural resources are few. It has few minerals—no coal, no iron, no copper, no silver. Its forests have almost disappeared. Only in spots is the land productive. The ancient Israelites, coming to it from the wilderness, called it "a land flowing with milk and honey"; but it was only through patient toil that they won an abundance for their needs, and it is not surprising that after so many centuries of neglect much of the country should become a waste. Even in Palestine's palmiest days water was so scanty as to be considered extremely precious. All through the Bible we find praise of water—of brooks and springs and wells. Rainfall was probably more abundant than today because of the greater number of trees, but seasons of drought often occurred even in those times. The rainfall is not evenly distributed throughout the year in Palestine. Practically all of it falls during the winter months, beginning in October or November with the "early" or "former rain," and ending with the heavy showers of March and April, called in the Bible the "latter rain." But almost everywhere the soil is rich, and with irrigation there is scarcely a place that could not be successfully cultivated, and yield good crops. One of the first steps in the rehabilitation of Palestine after the war was to conduct irrigation surveys.

Remarkable improvements have been made recently, especially in transportation. During the World War the British built a double track railroad from Port Said to Haifa, which has superseded Jaffa as the chief seaport. This links up with the Turkish line to Constantinople, so that it is now possible to

THE CITY OF NAZARETH AS IT LOOKS TODAY

As the Bible tells us, Nazareth was the childhood home of Jesus. It lies on the southern slope of the hill Jebel el Sikh, from whose summit a magnificent view is had commanding the plain of Esdraelon, from the Jordan on the east to the Mediterranean on the west, and southward to the hills of ancient Samaria. The modern city houses 10,000 people, many times more than the city in the time of Jesus.

go by rail from Cairo to Constantinople. Many excellent macadam roads have been built, and a pipe line brings water to Jerusalem from the Nile.

The population of Palestine is extremely mixed. About five-sixths are Arabs (Mohammedans in faith) and the remainder Christians or Jews. Many are nomads, or wandering shepherds, who have no fixed place of abode. In the settlement which followed the World War, Palestine was taken from the Turkish Empire and all west of the river Jordan was given to Great Britain under a mandate from the League of Nations. That government had already given a

DOWN TO THE PLAIN OF SHARON, 3,000 FEET BELOW JERUSALEM

This is one of the fine military roads built by the British during the World War. Highways like this, smooth as boulevards, have replaced the bumpy ruts which the natives formerly called roads.

For any subject not found in its alphabetical place see information

THE ROAD INTO THE LAND OF CANAAN

An Arab herdsman is watching his sheep in the region where Abraham, Isaac, and Jacob drove their flocks. Strange—isn't it?—that this ancient land should have been inherited by the sons of Ishmael the Wanderer, the one whom Abraham drove forth into the desert, while the sons of Isaac are scattered the world over! But wanderers these modern Ishmaelites remain. That's the herdsman's tent down there in the valley, and tomorrow perhaps he and his flock will be far away.

pledge to do everything it could to aid the realization of the Zionists' dream of "establishing in Palestine a national home for the Jewish people." But the obstacles to be overcome in the realization of this object are enormous, growing chiefly out of the scantiness in number of the Jews and the property and other interests of the large non-Hebrew population. (*See also* Jews; Syria.)

Palm. The silhouette of the palm tree, with its tall slender unbranching trunk surmounted by its wonderful crown of enormous leaves, is a sight which one could never forget or fail to recognize at first glance. The trunk mounts straight into the air, often for a hundred feet or more, suddenly bursting at the top into a rosette of leaves radiating from it like the outspread fingers of the hand. It is this resemblance that gives the palm its name, from the Latin word *palma*, meaning "palm of the hand."

In addition to these tall stately ornamental varieties, which include those with which we are most familiar—such as the coconut, the date, and the royal palm—there are other species which have quite different habits. Some of them, like the familiar potted palms in our houses, are mere shrubs. The dwarf palmettoes have buried stems and form low scrubby growths covering the ground like weeds, making, with their large prickly leaves, a well-nigh impenetrable thicket. Others, such as the rattan palms, have long slender ropelike stems which climb like vines and often are several hundred feet long.

Of these beautiful trees, more than 1,200 species have been described. They are found mostly in the Pacific islands, in Asia and America, and a few in Africa. Though they reach their greatest development in the rainy tropics, some species, such as the date palm (which is believed to be the palm of the Bible), grow in very arid regions, and others extend well into the temperate zone. Over 60 species of hardy palms are grown in California, where one of the most striking trees is the California fan palm. South Carolina is nicknamed the "Palmetto State" from the palmetto (*Sabal palmetto*), a small fan palm, which abounds in the lowlands and on the islands along the coast.

Palm leaves are of two main types: *fan-shaped* (palmate), as in the common fan palm and palmetto; and *feather-shaped* (pinnate), as in the date and the coconut. In some species the leaves are 30 to 45 feet long and 4 to 8 feet wide. The flowers are small and usually white, greenish, or yellow in color; they are borne in large clusters in the crown of leaves. The fruit in some species is no larger than a pea, while in others, as the double or sea coconut, it is sometimes larger than a man's head.

Next to the cereals and other members of the grass family, the palms are the most useful of all plants. Their fruits, stems, and leaves are used in a great number of manufactured products, besides furnishing food, shelter, and clothing for the natives of the regions in which they abound (*see* Coconut Palm; Date Palm).

Among important palm products may be mentioned palm-oil, derived from the fruits of the oil-palm (*Elaeis guineensis*) and other species, used for food, in soap-making, and as a lubricant; palm-wine, from the sap of several species; sago, from the pith of the sago palm (*Metroxylon*) and other varieties; rattan, the thin flexible stems of various species of Calamus; vegetable ivory, the nuts of the tagua or ivory palm (*Phytelephas macrocarpa*), from which buttons and many other small articles are manufactured. Many valuable fibers used in making brushes, hats, and baskets are derived from palms. Some of the commonest kinds are *raffia*, *piassava*, *kitool*, *African fiber*, *palmetto*, and *coir* or *coconut fiber*. Palms are the largest of all the Monocotyledons and belong to the family of *Palmaceae*.

Palmyra, Syria. It is five days' camel journey from Damascus across the Syrian desert to the ruins of Palmyra, the beautiful city from which Queen Zenobia 16 centuries ago held sway over a considerable kingdom on the eastern border of the Roman Empire, extending from northern Palestine to the Euphrates. The famous "city of palms," today a scene of dreary desolation, was once a capital of rare splendor. It can never have been more than a square mile in area, but the whole of that space was made beautiful. Through the center for nearly a mile extended a great quadruple colonnade of rosy-white limestone, 750 columns in all, each of them 55 feet high, and terminating in a triumphal arch. Beyond this, upon a terrace, stood the Temple of the Sun, its court surrounded by pillars intricately carved.

TEMPLE OF THE SUN AT PALMYRA

This great temple shows clearly the Greek influence which overspread ancient Syria. The temple before it fell into ruins, consisted of 390 columns in double or triple rows, and covered a terrace 750 feet square. It was surrounded by a wall 50 feet high.

The wealth which made this beauty possible began to pour into Palmyra before the Christian era, when the oasis in which the city stood became a trade post on the camel route by which the silks, perfumes, and jewels of the East were brought to the Mediterranean world. Heavy toll was taken from the caravans in return for protection from the desert tribes, and duties were levied on all imports and exports. The city's most splendid period extended from 130 to 270 A.D., when political importance was added to wealth by Rome's recognition of Palmyra as a valuable buffer state against the rising empire of New Persia. Zenobia's husband Odenathus was made viceroy of the East, in return for military operations against Persia. His glory was shortlived, for he was assassinated in 267, in the zenith of his success.

After her husband's death, Zenobia sought independent empire for her son, but the story of her splendid defiance of Rome—which you may read in Chaucer's 'Monk's Tale'—had a tragic ending. Her armies could not match strength with the vigorous soldier-emperor Aurelian, whose desert march to Palmyra was an achievement worthy even of a Roman, and in 274 the queen in golden chains graced his imperial triumph. The city was destroyed and thereafter the caravans took other routes.

Palmyra today is inhabited only by a few Arabs whose mud huts are built in the courtyard of the Temple of the Sun. Vast ruins remain, however, for the infrequent visitor to see—20 pillars or so of the great colonnade with their entablature intact, the sun temple, the aqueduct (still in use), the senate house, the arch, and many tower-tombs rising sometimes to eight stories. Palmyra is the Tadmor of the Bible (II Chron. viii, 4), which is said to have been built by Solomon.

Pan. In Greek mythology there is perhaps no more picturesque figure than Pan, the god of flocks and pastures, of fields and forests. He is represented as having horns, a goat's beard, pointed ears, a tail, and goat's feet. He led a merry life, dwelling in caves, wandering through wood and dale and over the mountains; protecting flocks, hunting and fishing, and dancing with the nymphs. He fell in love with the beautiful nymph Syrinx, the legend relates, but, frightened at his appearance, she fled from him, and was transformed into a reed. From this reed the god made the instrument known as the syrinx or Pan's pipes.

The mischievous Pan took delight in coming upon travelers unexpectedly and exciting the sudden fear which has come to be called "panic." He is often represented as accompanied by roguish, goatlike beings much like himself, called satyrs. These were the fauns of Roman mythology, the companions of Faunus, who occupied a position similar to that of Pan. The worship of Pan was introduced into Athens from Arcadia about the time of the Persian Wars, because of his supposed aid to the Athenians in the battle of Marathon.

In later times Pan came to be regarded as the god of universal nature, through confusion of his name with another Greek word meaning "all," and finally came to stand for all the Greek gods, and for paganism itself. So a legend arose that when Christ was born, a mighty voice proclaimed "Pan is dead," thus heralding the end of the power of the old divinities, and the beginning of the new faith.

Panama, Republic of. This little Central American republic, within which lies the Canal Zone, arose by a bloodless revolution in November 1903. The province of Panama had long been a part of the Republic of Colombia, which occupies the northwest

corner of South America. But relations had often been strained, and when the Colombian Senate refused to ratify a treaty confirming the transfer to the United States of the rights of the French Canal Company, the people of Panama declared their independence (Nov. 3, 1903). Ten days later President Roosevelt formally recognized the new republic, and on November 18 concluded with Panama the treaty authorizing the transfer of the French rights and leasing to the United States the Canal Zone. The $10,000,000 which the Colombian Senate had thought insufficient was handed over to Panama, and the treaty was in most respects the same as that refused by the mother state. Colombia charged that without the unneutral military aid of the United States the revolution would not have been successful, and on that ground asked an indemnity of the North American republic.

MUNICIPAL BUILDING IN PANAMA CITY

The municipal building, or city hall, of the capital is one of the fine structures erected since Panama became independent.

The Republic of Panama occupies almost the whole of the isthmus which joins North and South America, and is washed by the Caribbean Sea on the north and the Pacific Ocean on the south. It has an area of 32,380 square miles—a little more than that of South Carolina; and although its land boundaries are only 250 miles, its coast-line totals 1,245 miles. It is cut in two by the Canal Zone, a strip of land five miles on each side of the canal, over which, in accordance with the treaty, the United States exercises jurisdiction.

Under the example and influence of the United States, this region has been transformed from one of the most unsanitary and backward to one of the most healthful and progressive of tropical countries. The soil is naturally rich, and the climate varied by the mountains, making it possible to raise a great variety of crops in a small area. In the low-lands on the coast coconuts and bananas are grown. Back of this region is excellent sugar land, and still farther back the fiber plants and rubber trees thrive. In the higher altitudes tobacco, cacao, and coffee are raised, while the mountain sides and high plateaus are suitable for vegetables of the temperate regions. Bananas, hides, rubber, coconuts, and native curios are the chief exports.

Although the youngest independent state in America, Panama contains the oldest settlement on the mainland. It was visited by Columbus in 1503, and was a colony of Spain until 1821, when it proclaimed its independence and joined Colombia, of which it remained a part until the revolution of 1903. By the treaty of 1903 the United States pays Panama $250,000 annually, and may intervene with troops whenever necessary to maintain order in the Republic. The chief cities are Panama, the capital, with a population of over 60,000, and Colon, with a population of about 30,000. Total population of the country, more than 400,000.

A NATIVE VILLAGE ON THE BANYANO RIVER

The neat clean street tells the story of American influence on this native settlement, which once stood in the heart of the jungle

The engineers were ready; the workmen were at hand; yet the Panama Canal could not be built. Disease, spread by the mosquito, made life for the white man on the Isthmus impossible. Then came the scientist to show how this deadly foe could be conquered. It was he who opened wide the gate for the builders, as this symbolic picture shows.

For any subject not found in its alphabetical place see information

TRAGEDY *and* TRIUMPH *of the* PANAMA CANAL

PANAMA CANAL. Perhaps the most stupendous piece of work that has been done in America since the coming of Columbus was the building of the Panama Canal, and of all the stories in the world there are few more enthralling than this.

It is the story of man's struggle against the only living creatures that had yet a chance to beat him in the fight for the mastery of the world. For thousands of years two species of mosquitoes—*Stegomyia* and *Anopheles*—helped keep two oceans apart; but at last America has beaten them, and has linked the Pacific with the Atlantic by means of a canal in which giant steamships climb a water stairway over intervening mountains. A way has thus been made which brings the Atlantic sea-front of the United States 4,000 miles nearer to Australia, and saves 6,000 miles on the journey from Liverpool to Vancouver.

The rock Isthmus of Panama, only about 40 miles in breadth, has been famous in history since the days when Balboa and Francis Drake first made their separate ways through its tropical forests and looked out on the Pacific Ocean. Old Panama on the Pacific side became one of the key-points of the world, and across the isthmus ran the road to Porto Bello, over which the treasure hunters of Spain portaged their silver and gold to avoid the long voyage home by way of Cape Horn. After the discovery of gold in California in 1849, an American company built a railroad across the isthmus. It is said that 6,000 workmen died of tropical diseases during the construction—a life for every tie that was laid. But passengers gladly paid $25 fare to shorten their sea voyage; and even today, after the construction of the canal, this railroad—relocated and rebuilt—is still of considerable importance.

Chief Facts Concerning the Canal

Work begun by the Americans, May 4, 1904; canal opened, Aug. 15, 1914.
Total length of canal, 50.3 miles; bottom width of channel, 300 to 1,000 feet.
Number of locks, 12; length of each, 1,000 feet, width, 110 feet.
Height of Miraflores Lake, 54⅔ feet above sea level; of Gatun Lake, 85 feet above sea level.
Amount of earth and rock excavated, 239,000,000 cubic yards. Total cost of the canal, including payments to Panama, the French Company, and for sanitation, $375,000,000.
Time required for a vessel to pass through the canal, 10 to 12 hours.
Distances saved: New York to San Francisco, 7,873 miles; New York to Yokohama, 2,947 miles; New Orleans to San Francisco, 8,868 miles; Liverpool to San Francisco, 5,465 miles.
Government of Canal Zone: by a governor appointed by the President of the United States, assisted by an executive secretary who has charge of the postal system, schools, police, clubs, and libraries, and by the heads of the various departments, such as those of operation and maintenance, supply, purchasing, accounting, and health.

Deadly Rule of Stegomyia and Anopheles

But for all, the power in Panama was not with the king of Spain, nor with the treasure-hunters, nor with the buccaneers who fought and scattered desolation everywhere on the bordering seas. The kings of Panama were *Stegomyia* and *Anopheles*, who had no thrones of gold, but held the power of life or death over every man and woman and child on the isthmus. They took no taxes, made no laws, raised no armies—and commanded no respect. No traveler or subject bowed down to them. Yet in their power lay the destinies of this beautiful land; without a single word, without a single sword, they drove back mighty hosts and broke the power of nations. When a band of hardy Scotchmen, at the end of the 16th century,

founded a settlement on the Gulf of Darien, it was the forces of Stegomyia and Anopheles even more than the Spaniards who laid siege to their camp and put them to rout. And when, two hundred years later, Europe sent out its engineers to dig the Panama Canal, these insect kings were reigning still; and today tons and tons of rusted steel, and crumpled-up engines, and bars of iron that trees have picked up and twisted around their branches tell the tale of how Stegomyia and Anopheles dealt with those agents of civilization.

Like the Shadow of Death they reigned over Darien. Never have there been in the history of mankind two more powerful members of a ruling race.

Where the Dead Outnumbered the Living

For generation after generation they consumed the life-blood of the people who lived in this strategic region. The heat of Panama is such as only tropical travelers know; the terrific rainfall is almost beyond our imagination; and so, in a country with unmade roads, with only the roughest tracks beaten by the tramping feet of centuries of passersby, there was stagnant water everywhere. Moisture and warmth and a rich soil gave rise to luxuriant forests, tangled jungles of vegetation in which insects lived in countless myriads; and into the still lakes and pools and marshes poured a rushing stream of decay, of dead and dying animal and vegetable matter year after year, until it seemed natural that a city of 10,000 people, like Colon, should have 150,000 graves.

And so Panama came to be unfit to live in, a beautiful place befouled, until a traveler declared that "in all the world there is perhaps not now concentrated in any spot so much swindling and villainy, so much of foul disease, such a hideous dung-heap of moral and physical abomination."

Americans have dug the Panama Canal because they profited by the mistakes of Frenchmen who tried and failed. Let us remember their predecessors, brave men who faced disease and death, before science had placed in their hands the key to victory.

This is what happened when the great French engineer Ferdinand de Lesseps, who had already dug the Suez Canal, set out in 1881 as head of a French company and with a concession from the Republic of Colombia, to cut the American continents apart at the narrow Isthmus of Panama. There was a French consul there who advanced an engineer the money for a suit of clothes one day, and invited him to lunch the next; but the engineer did not come. He had died of yellow fever at three o'clock in the morning, and was buried at dawn in the new suit he had just put on. There was another Frenchman, the first director-general of the canal, who spent $150,000 in building a house on the top of a hill; but before the house was finished his wife and son and daughter had died of yellow fever, and the director-general went back to France alone, a broken-hearted man. Another man was sent to take his place; he settled down and began his duties, and died of yellow fever. A thousand men were sent to dig, and every man was dead within a year—from yellow fever. Another thousand took their place, and before the first year ended the second thousand were dead, too. Sixty-nine men in every hundred died at times; ten thousand after ten thousand brave workmen were stricken and fell.

So Death went about in Panama, and nothing could stop its terrible march. It was like poison walking in the streets. No man was surprised if the friend he had seen in the morning was lying in a grave at night. Yet, in spite of Death, the Frenchmen went on digging, and they did as well as anyone could have done in those dark days. For they were fighting Stegomyia and Anopheles; they were in the grip of the invisible armies of Death, and their very efforts to save their poor stricken men were destroying the lives of their comrades. There are few things in the history of the world more pathetic than this—that, in those days before the truth was known, the French doctors, to keep merely annoying insects out of the beds of the sick men, stood the bedsteads in bowls of water, in which the deadly mosquitoes were bred that spread the disease from which their whole enterprise was dying. So near to these poor doctors was the mysterious enemy which baffled them.

With 40,000 men and more than $260,000,000 spent, the great De Lesseps failed. His company went bankrupt, and a number of French public men were ruined in reputation by scandals connected with the "Panama Affair." De Lesseps died with a broken heart in Paris in 1894. His name is immortalized by his canal at Suez, but it is written across Panama in heaps of rusty iron and ruined machinery. There it lies in swamps and jungles, proclaiming to all the world the failure of human power against an invisible foe. It is all that is left of ten years of the labor of a great host of men, and the spending of *five dollars for every five minutes of time since Balboa, in 1513, first looked out from his peak in Darien.*

But if De Lesseps failed in the work at Panama, another Frenchman who stayed at home led the way to the discoveries in science which later enabled the United States to carry the task through to victory.

Science Masters These Age-long Foes

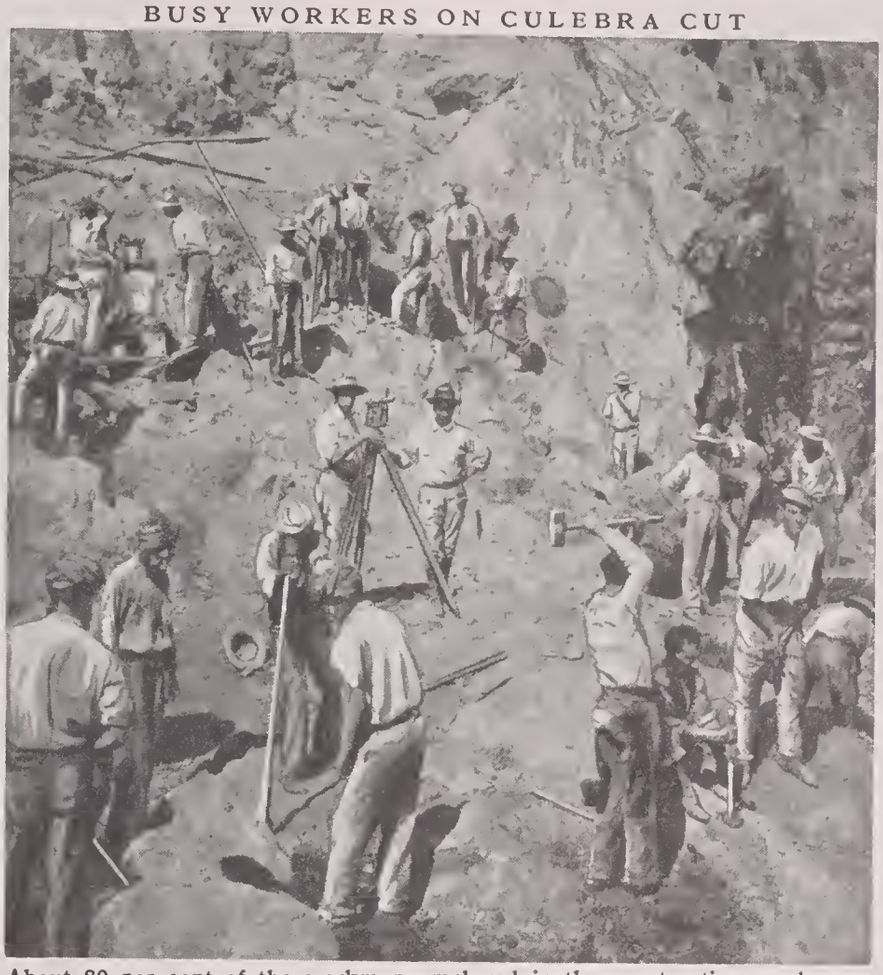
It was Louis Pasteur—the great French bacteriologist—who, looking through his microscope, first set men searching for the invisible enemies of Death at Panama, and thus led to the conviction of *Stegomyia* and *Anopheles* on the charge of destroying hundreds of thousands of lives.

What Louis Pasteur found was this: Man has against him in his march of conquest myriads of smaller creatures which, often before he knows it, poison him and may destroy him. Sometimes these creatures live on a man's body, so that we call them parasites, because they live on others; sometimes they have smaller parasites which live on them, so that even a harmless insect may carry a poisonous parasite and give it to a man with its sting. This great discovery of Pasteur, if it had been made a little while

before, would perhaps have saved the lives of all those Frenchmen who died in digging the canal; for it led to the discovery of the hidden enemy of life in Panama, and to the sweeping away forever—if we make good use of the discovery—of two of the greatest enemies that the human race has ever known.

We cannot stop to trace here all the steps in this great conquest of these enemies of man. In addition to the work of the great Pasteur himself, credit is due to his countryman Dr. Charles Laveran, who in 1880 first discovered the parasites which produce malaria; to Sir Patrick Manson, M.D., of London, who was one of the first to suggest that the mosquito was the active agent in its spread; to the Italian zoölogist Grassi, who first clearly demonstrated the effectiveness of preventive measures against the mosquito; to Sir Ronald Ross, M.D., in England, and to Dr. Walter Reed in the United States, who took the final steps in this great work.

BUSY WORKERS ON CULEBRA CUT



About 80 per cent of the workmen employed in the construction work were negroes and other natives of the West Indies. Of the remainder, Spaniards and Italians formed the largest part.

It was Dr. Ross who found out *Anopheles*, and Dr. Reed who found out *Stegomyia*; and what they found out was that *Stegomyia* carries in its body the parasites which cause yellow fever, and that *Anopheles* carries the germs of malaria, so that a bite from an infected mosquito of these species may bring death. The parasite which infects *Anopheles* is known. that of *Stegomyia* is still unidentified; but we know that both these fearful parasites inhabit the bodies of infected mosquitoes, which give them in turn to man when they suck his blood. Half their lives the parasites spend in the body of the mosquito, and half in the body of man, whom for centuries they have destroyed (*see* Mosquito).

So this knowledge which is power came into the world. Now, at last, the world came to close grip with these two mortal enemies.

For 70 years the United States had taken an interest in various projects for an isthmian canal to link the Pacific with the Atlantic, and in 1850 the Senate had ratified the Clayton-Bulwer treaty with Great Britain to pave the way for such a work. American opinion, however, had mostly favored what seemed the easier, though longer, route by way of Lake Nicaragua.

The withdrawal of De Lesseps' company directed attention anew to the Panama route, and in 1903 the United States bought out the French rights for $40,000,000. An additional payment of $10,000,000 to the new Republic of Panama, formed by revolt from Colombia (*see* Panama, Republic of), brought a confirmation of the transfer, the grant to the United States of the 10-miles-wide "canal zone," and cleared away all obstacles to active construction.

The task which the United States had assumed was to cut the continents in two at the narrow point from Panama to Colon, and let the world's ships sail through. It sent 30,000, then 40,000, then nearly 50,000 men to do the work; and over this army of workers it placed two of those modest, scientifically efficient, dogged officers of the Regular Army to whom we so often turn to do great tasks without fear, faltering, or favor —Gen. George Washington Goethals as engineer-in-chief, and Col. William Crawford Gorgas, M.D., as chief sanitary officer (*see* articles under these names).

Colonel Gorgas Conquers the Mosquito

Armed with the knowledge given to the world by the discoveries of Major Ross and Dr. Reed, and with his own experience gained in stamping out yellow fever in Havana following the Spanish-American War, Colonel Gorgas went out to Panama again to confront *Stegomyia* and *Anopheles* face to face. It rested with him and his fellow sanitarians whether General Goethals and his engineers should successfully complete their great task, or whether the United States should retire defeated, like France, by the age-long forces of Disease and Death.

Colonel Gorgas proved equal to his opportunity. He was worthy of that long line of scientists who have brought the triumph of modern medicine. He

ONE OF THE GIANT LOCKS AT GATUN

This picture, taken while the lock was under construction, gives you a good idea of the tremendous size of the structure. The chamber is 1,000 feet long and 110 feet wide. The gates at the end are 7 feet thick and 76 feet high.

had against him all the ignorant little people who are always against the man who knows; but he stood firm, like a strong man, with the eyes of the world upon him. He screened up all the houses, and ordered every household to cover up all vessels that held water. He drained lakes and swamps that had never been drained before, and poured out the filth of ages to the sea. He drained every ditch and pond that could be drained. Over those that could not be drained he spread a film of oil, so that the larvae of the mosquitoes in them could not breathe; and thus sealed up the breeding places. He cut grass jungles to the ground, destroyed all vermin, and burned all rubbish. He raised all buildings up above the ground, and screened windows, doors, and porches with fine wire screens. He screened every train, and on every train he put a hospital car. He ordered alcohol out of the Canal Zone, and made it prohibition territory. And the result of all these measures was that the forces of *Stegomyia* and *Anopheles* were put to rout, and from one of the most unhealthful spots in the world, the Isthmus of Panama became one of the most healthful. The death-rate of the city of Panama is now the lowest of any large body of people in the world—less than eight per thousand, and less than three among white Americans.

It is perhaps the greatest *school-lesson* that has ever been taught to the world, and the cost of it—you will not believe it, but it is perfectly true—has been equal to a cent per man per day. That is the whole cost of Dr. Gorgas and his staff, who wrought this tremendous transformation and made possible the construction of the giant canal.

Equally marvelous was the work done by General Goethals and his troops of engineers and workmen, with their giant American excavators, dredges, and other machines, which excelled those of De Lesseps as much as the science of a Gorgas exceeded that of the earlier French medical officers.

Goethals Directs the Battle of the Builders

Henceforth for ten years you could have seen such a sight as the world perhaps had never witnessed since the building of the Pyramids or the Great Wall of China. The tropical sun beat down upon a vast panorama of industry. Swarming in the mighty cuts were legions of perspiring laborers, white and black, some in shirt sleeves, some almost naked. Some toiled with pick, shovel and crowbar, and others with drill and dynamite in the stone cuts. Series of cableways and a network of railway tracks were everywhere. The mighty derricks and cranes swung huge cement blocks through the air and lowered them into place to form locks and embankments. Powerful steam drills bored holes into solid rock at the rate of seven feet an hour. Monster dipper dredges rose and fell like signal arms from thumping machinery on

CLEANING UP THE CITY OF COLON

One of the first tasks of the American engineers was to clean up the towns. These two photographs show the same section of Tenth Street, Colon, before and after paving. Paving the streets not only made traffic easy, but it gave the city a new appearance and made the residents eager to keep clean.

Gorgas, the American army doctor, commanded the fight for health. He drained every ditch and pond that could be drained, and over those that could not be drained he spread a film of oil which killed the mosquito larvae. He destroyed all vermin, burned all rubbish, screened windows, doors and porches, screened every train, and on every train put a hospital car. From one of the most unhealthful spots in the world, the Isthmus of Panama became one of the most healthful. During the ten years of American work on the canal, there were only 663 deaths, making the death rate 1.7 per cent, which is lower than in the large American cities. The death rate during the ill-fated attempt of De Lesseps to build the canal was 7,800 a year!

contained in the Easy Reference Fact-Index at the end of this work

GENERAL VIEW OF THE GAILLARD OR CULEBRA CUT

The upper photograph shows the work of excavation in progress; the lower shows the battleship *Wyoming*, 554 feet long, with a beam of 93 feet, in the center of the canal at this point. It is here that engineers have had much difficulty with great slides of earth which fall into and block up the canal.

By executive order of President Wilson in 1914, Culebra Cut was officially renamed Gaillard Cut, to honor Lieutenant-Colonel David Gaillard (1849-1913), the engineer who was in charge of construction of this section of the canal.

For any subject not found in its alphabetical place see information

THE GATUN LOCKS IN OPERATION

Electric locomotives draw the ships through, thus avoiding the danger of damage to the locks, which would be almost certain if ships were allowed to proceed under their own power. This ship has entered the lock from the Atlantic side, and will be raised to the level shown by the blackened sides of the enclosure before proceeding into the next lock.

The battleship *Arkansas*, sister-ship of the *Wyoming*, is passing through one of the locks at Gatun. The canal will accommodate the largest American battleships. Ninety per cent of all the vessels on the high seas are less than 600 feet long, and would pass through the locks with plenty of room to spare.

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barges in swamps and bays. More than 100 steam shovels doing the work of 10,000 men dug up earth by ten-ton scoopfuls and dumped it into waiting railroad cars. One hundred and fifteen locomotives were engaged in hauling trains of these cars to the dumps, and there a thing like a great plow traveled from one end of a train to the other unloading 20 cars, each carrying 600 tons, in less than ten minutes, and performing the work of 400 laborers. The earth which was excavated and removed amounted to more than 239 million tons, and would make a line of 63 pyramids, each the size of the Great Pyramid of Egypt.

Instead of cutting a sea level canal through the mountain divide as the French had planned, the American plan was to leave the central section 85 feet above sea level, and to construct a "water stairway" of great "locks" by which ships could climb up one side of the divide and down the other end.

Even with this advantage it was still necessary in places to make cuts more than 300 feet deep. The mountains were blasted away with dynamite in charges of 100 to 40,000 pounds. More than 1,000,000 blasting cartridges were exploded every year. The very jungle rocked under the cannonading of this mighty battle of peace.

There was a fine spirit of rivalry among the men of the three great divisions—the Central, Atlantic, and Pacific divisions—and strong men worked like schoolboys to beat the record. There was no time for quarreling or abuse, and an official circular gave notice that "the use of profane or abusive language by foremen or others in authority, when addressing subordinates, will not be tolerated." A fine thing it was to see this workshop 45 miles long, with men working in comradeship in a great world cause.

The work progressed in the face of incessant difficulties. Once there was an earthquake. Heavy rains brought terrific landslides, as in the great Gaillard or Culebra cut, which often undid the work of months. The Chagres River was particularly troublesome because of its floods, but it was conquered by the construction at Gatun of one of the mightiest dams in the world, made of earth and rock, a structure a mile and a half long, half a mile wide at the base, and 100 feet wide at the top. Thus the Chagres, banked by hills, was turned into a lake of 164 square miles—the largest artificial lake in the world—and the engineers avoided having to cross and recross its course.

So for nearly ten years the digging and dredging and building of concrete walls and locks went on. Then on Oct. 10, 1913, President Wilson, 4,000 miles

OPENING THE SPILLWAY AT GATUN DAM

At the time of its construction, this was the largest dam in the world. It is nearly 1½ miles long measured at the crest, and half a mile thick at the base. At the surface of the water the dam is 400 feet thick. Twenty million cubic yards of material were required to build the dam. The concrete spillway shown in the photograph is 1,200 feet long and 300 feet wide, cut through a hill of rock in the center of the dam. It required 225,000 cubic yards of concrete to build the spillway alone. This spillway allows the surplus water from Gatun Lake to empty out through the Chagres River.

WHERE THE CANAL GETS ITS WATER

The photographer who took this picture was looking almost directly east, and yet he was facing toward the Pacific. You will see why if you turn to the map on page 2662. At the left of this picture is the railway bridge which marks the end of the Chagres River and the beginning of Gatun Lake. It is this river which supplies the vast volume of water necessary to operate the canal.

A VIEW FROM MIRAFLORES LOCKS

If you were crossing from the Pacific to the Atlantic side, this is the general view you would have just as your ship prepared to enter the Miraflores Locks at the Pacific end of the canal. Between the two highest hills in the background is Gaillard or Culebra Cut. The hill on the right is Gold Hill; the one on the left is called Contractor's Hill. At the far end of the lake, just before the canal enters Gaillard Cut, are the Pedro Miguel Locks.

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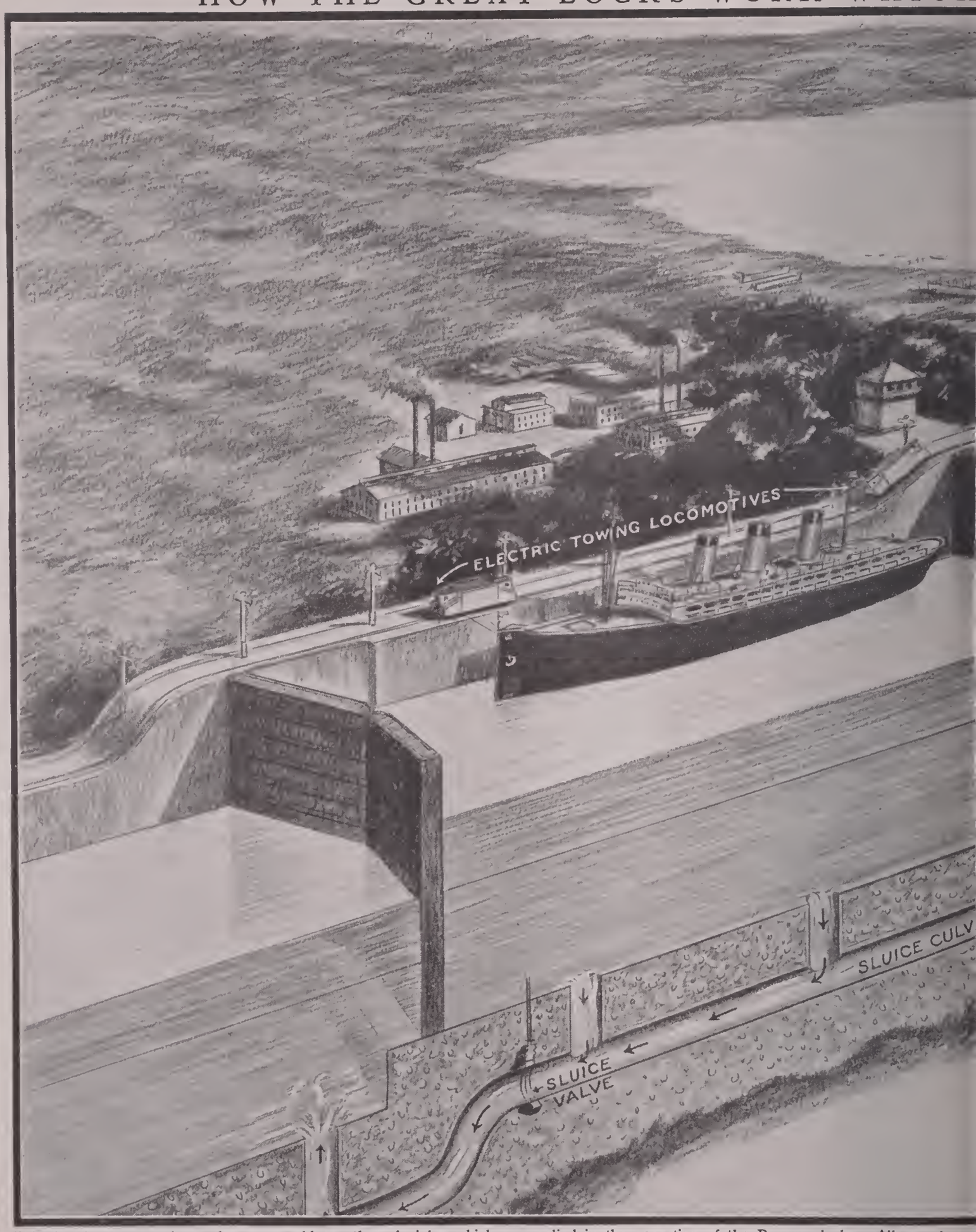
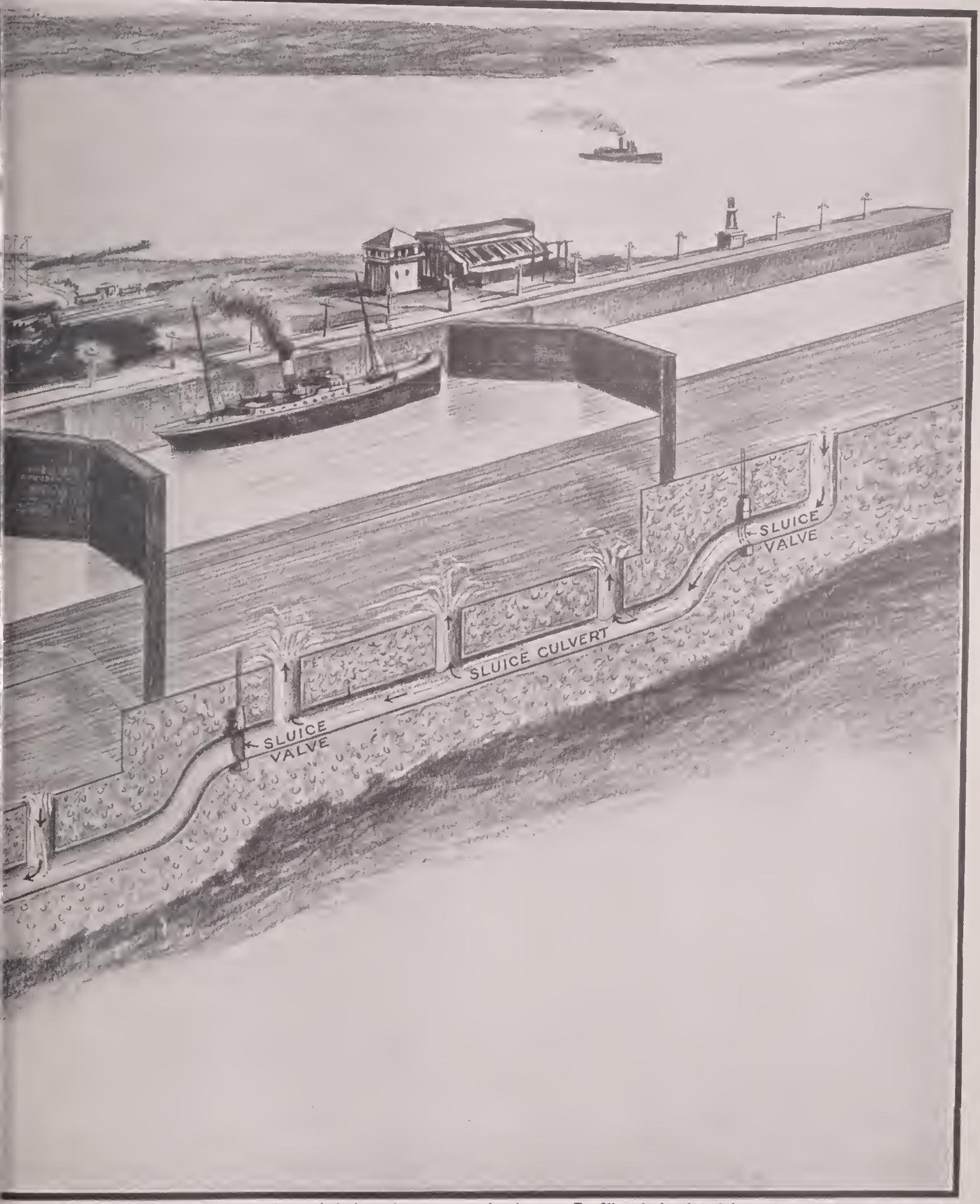


This drawing was made so that you could see the principles which are applied in the operation of the Panama locks. All vessels are towed into and through the locks by electric locomotives, which run on cog-rails laid on the tops of the lock walls. For each flight of locks there are two towing tracks, one on the side and one on the middle wall. Usually four locomotives are required: two ahead, one on each wall, to pull; and two behind, one on each wall, to keep the ship in the center of the lock and to stop it when necessary. Each locomotive is equipped with a slip drum and hawser, so that the towing line may be paid out or taken in without actual motion of the

For any subject not found in its alphabetical place see information



locomotive. The locks are filled and emptied through a system of culverts. To fill a lock, the sluice valves at the upper end are opened, and the lower valves closed. The water flows through the culvert and up through the holes in the floor into the lock chamber. To empty a lock the upper valves are closed and the lower ones opened. The water then flows out of the lock chamber, through the culvert, and out into the lower lock or pool. The main culverts under the walls are 18 feet in diameter, while the smaller ones leading under the lock floor are 3½ feet across, allowing a rapid transfer of water.

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away in the White House in Washington, pressed an electric button which sent a flash over wires and cables and set off a tremendous charge of dynamite that blew out a temporary dike. A flood rushed through a rock-walled rift in the mountains, and the Panama Canal was a dream realized! The greatest engineering wonder of the world had been achieved by American engineers at a cost of $375,000,000. The little Republic of Panama marked the red letter day by putting a new motto on its official seal: "A land divided; the oceans united." On Aug. 15, 1914, the canal was first opened to the commerce of the world. We can understand the spirit of the traveler who was carried away by the sight of it and wrote these words: "A region is being shaped anew. Cut, carved, transformed, it has now another form and another outline. Peaks have disappeared, other heights have risen; certain valleys have vanished, others have been born; great rivers have obediently followed the will of man, as in the Arab legend the sea, roaring and foaming, followed the steps of Lalla Muna, the Moroccan saint. And across the yellow virgin earth has at last been opened a deep monstrous furrow, which the waters now invade. The gigantic shipway passes from sea to sea, and possibly is visible to other planets—a slender, luminous, strange new sign on the old and immutable face of the world." He described the achievement admirably.

WHERE THE ATLANTIC IS WEST OF THE PACIFIC

Doesn't this map seem puzzling when you first look at it? There's the Atlantic to the west where the Pacific ought to be. Yet it is perfectly accurate. The Isthmus of Panama, as you can see on the little map in the upper left-hand corner, takes a dip to the southwest at this point. This makes the Atlantic end of the canal actually further west than the Pacific end. The dotted lines indicate the boundaries of the Canal Zone.

What is the "big ditch" like today? Imagine you have taken a steamer at New York, sailed down the Atlantic coast, and across the blue palm-fringed Caribbean Sea to Limon Bay. The harbor is dotted with ships under the flags of a dozen nations. From war vessels to pleasure yachts they take their place in the processions passing into and out of the canal. The Toro breakwater, which extends two or three miles out into the sea as a protection against destructive winds, looms up in front of you, and you steam around it into the canal entrance, where a government pilot boards the ship.

On your right you see the steel-concrete piers, commissary houses, and hospitals of Cristobal (Christopher), the new port of the Canal Zone; on your left the white houses and red roofs of Cristobal's twin city, Colon (Columbus), which along with Panama City flies the flag of the Panama Republic. Past the great bronze statue of Columbus you sail into the canal across the low coastal belt through a channel 500 feet wide and 40 feet deep, the minimum depth of the canal. The tropical forest has been pushed back, but you see it on each side, with its great ferns, delicate creepers, and brilliantly colored birds and blossoms. The shores begin to rise and the waterway to bore into the hills.

You sail seven miles, and suddenly the way is blocked by an enormous wall of concrete masonry, with a double steel gate in the middle. This is the entrance to the first of the three locks at Gatun. The right half of it opens in two leaves, seven feet in thickness and weighing perhaps 600 tons, and in you sail. Then you see that a central concrete partition, 60 feet wide, resembling a boulevard even to the lamp-posts, divides the canal into two sections, one for incoming, the other for outgoing vessels.

The engines of your ship are stopped, and four electric locomotives on cog tracks on the canal walls —which are 50 feet wide at the bottom and 8 feet wide at top—slowly tow the ship into the lock by hawsers made fast to bow and stern. The gates close behind, shutting the vessel into the great chamber. Each lock is 1,000 feet long and 110 feet wide. From

a huge unseen culvert water pours into the lock through great holes in the concrete floor, and your ship slowly rises until it is at the level of the next highest lock; then new gates open, and in you sail to the next lock. Twice the process is repeated, a half hour being spent in each of the three locks, until the wonderful water stairway has lifted the ship to the 85-foot level of Gatun Lake. Here the engines start again, and you are off full speed for a 24-mile run across this great artificial lake.

Through Gatun Dam and Lake

Behind you to the right is the Gatun dam, holding in all those waters in this enormous elevated reservoir, which supplies water to the locks. At the center of the dam is a concrete spillway to let the surplus waters escape through 14 gate-controlled openings into the lower Chagres River, so that the lake may be kept at the right level no matter what may be the rainfall. Three giant generators, run by this overflow, supply electricity for operating the mighty hidden machinery of the locks and spillways, and for running the towing locomotives. They also supply electricity to the canal villages and for the range lights which guide ships at night from pairs of concrete towers 60 feet high all along the canal. Everywhere the scenery is entrancing. A palm-thatched hut perches on every hilltop, and groves of trees, draped with vines and Spanish moss, lift their drowsy heads above the waters. From Gatun Lake you sail into the Gaillard cut, a great gash through the central divide, more than 300 feet wide at the bottom, and sloping up to towering cliffs covered with tropical vegetation.

Eight miles more, and you begin to descend the water stairway. Through one lock at Pedro Miguel the ship drops down about 30 feet, to the level of Lake Miraflores, two miles wide; and later two more locks lower you to sea level. From here you can see in the distance the new American port of Balboa, on the Pacific side, destined to become one of the greatest of tropical seaports, with coal docks, dry docks, machine shops, warehouses, and a naval station. A trolley line runs down the coast to Panama City, the gay quaint old Spanish capital. Finally you steam $8\frac{1}{2}$ miles through a 500-foot channel out into the deep waters of the Pacific.

The total length of the canal is about 50 miles, only about 15 of which are at sea level. The passage requires 10 to 12 hours, and about 40 ships a day can pass through each way. The entrances are defended by some of the strongest fortifications in the world.

What Does the Canal Accomplish

What does this great short cut mean to the world? Probably no other engineering achievement will ultimately have a more decisive effect on the destinies of nations. For the United States and its sister American republics, the opening of the canal was the inauguration of a great new Pan-American era of commerce, friendship, and peace. No countries will reap greater benefits from it than the Pacific republics of South and Central America, whose age-long isolation from the Atlantic countries has now been ended. Goods, mails, and immigrants can come to them more speedily and safely, and their products can reach markets more cheaply and quickly. In fact, the canal brings the ports of the west coast of South America closer to New York City than are the ports in corresponding latitudes on the east coast of South America. The route to Valparaiso, Chile, for instance, is shorter than the route to Buenos Aires, Argentina.

For the United States and Canada, the water distances between Atlantic and Pacific ports have been cut in half or more. By way of the Strait of Magellan, the distance from New York to San Francisco is 13,135 miles; by Panama, 5,262 miles—a saving of 7,873 miles. From New Orleans to San Francisco it was 13,551 miles before the canal was opened, now it is 4,683 miles—a saving of 8,886 miles, or practically a month's steaming for freighters. The Atlantic coast is now nearer to Australia and Japan than is any North European city, and New York is now as close to Hong Kong as is London.

The canal is also of inestimable strategic importance to the United States navy. Indeed, this was one of the chief reasons for its construction, for the long voyage of the *Oregon* around the Horn in the Spanish-American War had aroused the nation to the need of the canal. It now makes possible the concentration at either entrance of a fleet which, with a cruising speed of 15 knots, could reach the center of the Pacific coast in nine days and the center of the Atlantic coast in five days. Fleets stationed opposite the middle of each coast are now as near as if one were off New York and the other off Buenos Aires; whereas formerly, from the point of view of naval strategy they were as far apart as if they were stationed on opposite sides of the globe.

The Price Paid to Panama

In addition to the $10,000,000 paid at the time of the treaty leasing the Canal Zone to the United States, the Republic of Panama receives a yearly rental of $250,000. To protect the canal from hostile attack, the United States has been obliged not only to fortify its approaches, but also to assume a measure of control over all the Caribbean waters. But the building of the canal is only one of many factors taking the United States out of its isolation, and leading it into active participation in great world affairs.

PANDO'RA. According to the Greek legend, Pandora was the first woman on earth. When Prometheus (*see* Prometheus) stole the fire from heaven and bestowed it on mortals, Zeus caused a woman to be made to bring trouble to man. She was fashioned by the artisan-god Hephaestus, and each of the other gods conferred upon her some gift. Aphrodite gave her beauty, Hermes cunning and persuasion, and Athena gave her feminine accomplishments. Zeus sent her to Prometheus' brother, Epimetheus, who gladly accepted her, though Prometheus had cautioned him against her. Pandora brought with her a jar in which were all men's ills and troubles. When the jar

PANDORA, JUST AFTER SHE OPENED THE JAR

After Hephaestus (Vulcan) had fashioned the first woman out of clay, the gods were so pleased with his workmanship that they gave her every charm and made her irresistible. They named her Pandora, which means "all-gifted." Prometheus ("forethought") had warned his brother to accept no gift whatever from the gods, but Epimetheus ("after-thought") was captivated by the beautiful being and made her his wife. Thus he brought misfortune to all mankind.

was opened these escaped and spread over the earth, hope alone remaining. Another story has it that the jar contained all blessings, which would have been preserved for man had not Pandora, out of curiosity opened the jar and allowed all but hope to escape.

PANSY. What is more charming and pleasing than a bed of these smiling flower faces nodding to you as they sway to and fro in the summer breeze! So roguish are they that it is sometimes hard to realize that they are merely flowers. The name pansy is taken from the French word *pensée*, meaning "thought," and—

> Of all the bonny buds that blow
> In bright or cloudy weather,
> Of all the flowers that come and go
> The whole twelve moons together,
> The little purple pansy brings
> Thoughts of the sweetest, saddest things.

This familiar garden favorite is a cultivated species belonging to the violet family. The story is that some 300 years ago someone carried specimens of the modest little wild flower from the woods to a cool moist place in his garden. There in course of time, by selection and cross-fertilization, the flowers became larger and more brilliant, with rich coloring ranging from white and yellow into orange, dark brown, blue, violet, and purple; and so grew into the pansy of today. Now we may buy the plants and set them out in beds in the garden; but the cheapest way is to buy the seed. Seeds sown under glass in February or March produce plants ready to transplant in May, blooming in July if given proper care and attention.

That the pansy is a favorite with everyone is shown by the quaint names given it such as "Cuddle-me-to-you," "Love-in-idleness," "Heartsease," and many others. Shakespeare immortalized the pansy in 'Hamlet': "There's rosemary, that's for remembrance; pray you, love, remember; and there is pansies, that's for thoughts."

Scientific name of pansy, *Viola tricolor*. Flowers have five unequal broad petals, five short stamens, five sepals eared at base; leaves long, sharp-pointed, sometimes oval, growing direct from stem; stem slender, one-half to one foot high, with single flower.

PAPACY. The "papacy" means the office of the pope of Rome and denotes the system by which he governs the Catholic church. The word "pope" is the English form of the Latin *papa* (derived from the Greek *papas*), meaning "father." The title pope was in early times given to all bishops; later it was restricted to the Bishop of Rome, the patriarchs of Alexandria, Antioch, Jerusalem, and Constantinople. At the present time it is employed by the Roman Catholics solely to denote the Bishop of Rome, who is regarded as the successor to St. Peter, and the chief pastor of the Universal Church. It was apparently in the 4th century that the word pope was first used as the distinctive title of the Roman pontiff. The head of the Roman Catholic church has other titles, such as "Holy Father"; "Vicar of Christ"; "Pontifex Maximus" (literally, "chief bridge-builder," given presumably in imitation of the early Roman emperors, who exercised civil and religious functions); and *Servus Servorum Dei* ("the servant of the servants

IN THE LIBRARY OF THE POPES

This hall in the Vatican looks more like an art museum filled with priceless treasures than like a library, but it contains about 40,000 ancient and medieval manuscripts, and over 400,000 printed books. The ceiling is of mosaic, inlaid with mother-of-pearl, and the paintings on the walls are by celebrated masters.

of God"), which is now so exclusively a papal title that it is found in all official documents such as bulls and briefs.

According to Roman Catholic teaching, Christ in founding the church as a visible institution gave to St. Peter primacy over the other apostles, and made St. Peter his representative on earth by investing him with the three prerogatives of king, priest, and teacher, and bestowed upon him the highest legislative, priestly, and doctrinal authority. The primacy had been *promised* to St. Peter before the Resurrection, and was conferred when Christ manifested himself to St. Peter and the other apostles on the banks of the Sea of Tiberias. (This teaching is based upon what are termed the Petrine texts, found in Matthew xvi, 17–19; Luke xxii, 32; John xxi, 15–17.)

As the church was to endure till the end of time, Peter must have a successor, who, as Bishop of Rome, should be the Vicar of Christ on earth. History bears complete testimony that from the earliest times the Bishop of Rome has ever claimed the supreme headship of the Roman Catholic church, and that this headship has been universally acknowledged by all within the fold. The pope becomes chief pastor of the church because he is Bishop of Rome; he is not Bishop of Rome because he is chosen head of the church. As head of the church, the pope acts successively as Bishop of Rome, Archbishop of the Roman Province, Primate of Italy, and Patriarch of the Western Church.

In virtue of his position as head of the Roman Catholic church, the pope is its supreme teacher, legislator, judge, and governor. As supreme teacher he formulates what is to be believed by the members of the church, and takes measures for the preservation and the propagation of the faith. He alone can prescribe and regulate its liturgical services. As the supreme legislator of the church he makes laws for all its members, and has full authority to interpret, alter, or abrogate his own legislation or that of his predecessors. As supreme judge the pope can impose penalties either by judicial sentence or by general laws. As supreme governor he has the right of appointment to public ecclesiastical offices, such as the nomination of bishops, the establishment of dioceses, the approval of religious orders, and the authority to impose taxes on the clergy and laity for ecclesiastical purposes.

Though the pope's authority is supreme, it must not be understood that it is either arbitrary or unrestricted. He is directed in the exercise of it by the spirit and practice of the church; by ancient statutes and immemorial customs; by the very purpose of the papacy as expressed by Christ at the time of its institution: "Feed my lambs. . . . feed my sheep" (John xxi, 15–17). The pope is aided in his administration by a number of commissions, tribunals, and offices, collectively known as the *Curia Romana.* The commissions, known as "Roman Congregations," are 13 in number, each dealing with some special

branch of work; the "Congregation of the Propagation of the Faith," for instance, having supervision of missionary activities; the "Congregation of the Bishops and Regulars" regulating the affairs of religious orders—monks, friars, and nuns. There are two tribunals, one for matters of private conscience and the other for cases between individuals. Appeal from the decisions of the latter may be made to the Apostolic Signatura or supreme tribunal.

Among the offices are the Papal Chancery, which sends out those formal documents issued under the pope's seal called "bulls," (from the Latin *bulla*, a leaden seal); the Apostolic Chamber, which has charge of finances; and the office of the Secretary of State. This official is perhaps the best known of all representatives of "the Vatican," as the papacy is often called from the place of the pope's residence; for all the political affairs of the church, its dealings with foreign nations, etc., are conducted through him. From his office, also, are issued those less formal public letters, known as papal "briefs." The members of the "Congregations" as well as other chief administrative officers are almost always cardinals (*see* Cardinals, College of).

The pope has primacy of honor as well as primacy of jurisdiction over all bishops of the church. He ranks first among Catholic princes; is independent of every temporal ruler; and in Catholic countries his ambassadors have precedence over other members of the diplomatic body.

For fully ten centuries the pope was a temporal as well as a spiritual sovereign, and ruled a district stretching across central Italy from sea to sea, known as the Papal States or "the Patrimony of St. Peter." Temporal power was wrested from the papacy in 1870, when the present kingdom of Italy was formed, with Rome as its capital. Though no longer a temporal ruler, the pope still has diplomatic relations with nearly all the nations; and acts as arbiter in international misunderstandings. Leo XIII, in 1885, acted as such in the dispute between Spain and Germany with regard to the Caroline Islands, and in 1897 the same pontiff arbitrated between Haiti and San Domingo.

The papacy is the most venerable of existing institutions. We can trace the line of Roman pontiffs in an unbroken succession back through the centuries from Benedict XV, the present occupant of the papal chair, to St. Peter, the first pope.

As to the manner in which the pope is elected, the method has varied at different periods. In early days the pope was elected by the clergy and the faithful of Rome. At the present day, the election is made by the College of Cardinals assembled in conclave. There are four possible forms of election; the usual form, however, is the "scrutiny," or secret ballot, in which to be successful a candidate must receive a two-thirds vote. (*See* Benedict XV, Pope; for a complete list of the popes *see* the entry "Pope" in the Fact-Index.)

HOW PAPER IS MADE—*Its Priceless Value*

WHAT the wire conductor is to electricity, paper is to knowledge—the medium without which its wide conveyance and use would be impossible. Without paper, introduced at about the same time, the invention of printing would have been useless, and the very existence of such a republic as the United States impossible. Without cheap and plentiful paper its citizens, ignorant of one another's thoughts and desires, could never act together. Paper is a bond stronger than steel in the free countries of today. Modern science and invention, too, owe their existence largely to the abundant supply of paper which makes knowledge, as it were, an all-pervasive and life-giving atmosphere.

PAPER. Everywhere we turn we find paper. Our magazines, newspapers, and books are made of paper. In a single year the newspapers of the United States and Canada use enough newsprint paper to belt the earth 50 miles wide. In the form of the standard 73-inch roll this paper would unwind to a length of 13,000,000 miles. We wrap our bundles in paper. The ice cream soda is served to us at the soda fountain in paraffined paper containers. Our snapshots and all our photographs are printed on sensitized paper. We use paper tablets or writing paper for writing. Tin cans and bottles of medicine and chemicals have paper labels. The walls of our houses are decorated with wall paper. Cardboard boxes are used for countless purposes. The sandwiches which we carry to school or to picnics are wrapped in oiled paper to keep them moist and fresh. It would be difficult to think of life today without paper.

The first paper-makers still ply their trade just as they have done for ages on ages. They are not human beings, but wasps; and it is said that a Chinese sage, watching some of these insects build their nest, gained the idea which resulted in the first man-made paper. At all events, the Chinese were making paper in very early times—apparently before the Christian era.

The early Egyptians, 3,000 years or so before the Christian era, made a writing material from the papyrus plant (from which comes our word "paper") that grew in great profusion on the banks of the Nile (*see* Papyrus Plant). This papyrus "paper" was made by laying thin slices of the stem with their edges overlapping across other slices at right angles to them. The whole was moistened with water, pressed down, and the rough places smoothed off with ivory or a smooth shell. The slices were glued together, either by the natural gum contained in the fresh stems or by some other adhesive, to form a tough white or ivory-colored sheet, which with age became brown and brittle like the papyrus we see in museums now. Papyrus for documents and correspondence was

exported from Egypt to Rome and Greece, and was so indispensable that a failure of the Egyptian papyrus crop during Tiberius' reign threatened to upset the ordinary business of life in the Roman Empire.

It is said that the failure of a king of Pergamum (which was once one of the greatest cities of Asia Minor) to obtain the papyrus he needed for the enlargement of his library led to a return to the old custom of using carefully prepared skins of goats, sheep, and calves for writing material, and from the new vogue given to this material it came to be called "parchment" (from "Pergamum"). Between the 3d and 7th centuries parchment and vellum (a very fine parchment made of calfskin) displaced papyrus in Europe; the wonderful illuminated manuscript books of the Middle Ages were written on the new materials, which possessed the merits of great smoothness and toughness. These were the only available writing surfaces in Europe until after the 8th century the Saracens carried to Spain the art of paper-making, which they had learned from the Far East.

THE FIRST PAPER FACTORY

The Hornet knew the secret of paper making ages before men found it out. Here we see one of the Hornet's paper houses. With her strong jaws, the female shaves off tiny particles of wood and chews them up into a pulp. This pulp she spreads out thin, layer after layer, and as it dries it turns into a tough springy paper.

The spread of the new art was slow and paper did not become common until the 14th century. It gradually superseded parchment and vellum in the 15th century—just in time to establish the usefulness of the new invention of printing; for what would have been the good of a way of multiplying books if the only substances on which they could be printed had been as scarce and costly as papyrus, vellum, or parchment?

ALL THIS FOR ONE SUNDAY PAPER

The scale indicates that this newspaper weighs less than two pounds. Yet more than five pounds of material—shown in the pile at the left—were required for its making. The 3 pounds of spruce wood, 1 ounce of sulphur, 1 ounce of bleaching powder, 1½ ounces of unslacked lime, and the red and blue dye are converted into enough stock for one newspaper by about 2 pounds of coal.

Practically any fibrous or cellulose-containing vegetable material can be used for making paper (*see* Cellulose). In Asia the bark of the paper-mulberry was generally used. Cotton and linen rags, cleaned, soaked, boiled, reduced to a pulp by beating and grinding, the pulp spread in thin layers and dried between sheets of felt, were the materials most widely used by the paper-making industry in Europe until the middle of the 19th century. Rag papers, made by hand, sheet by sheet, though far cheaper than parchment, were yet much too costly to render practicable a modern daily newspaper, with its many huge double sheets to a copy and its edition of half a million copies daily—to mention only one instance of our extravagantly lavish modern use of paper. About the beginning of the 19th century the modern process of paper-making by machinery was invented, and by the middle of the century it had supplanted the hand processes for all but the very finest grades.

Meanwhile all kinds of vegetable fibers were being tried out in paper-making. The huge expansion of the paper-making industry followed on the perfection and general adoption of processes for making print paper from wood pulp, in the second half of the 19th century.

By far the greater part of the world's output is now made from wood pulp. Linen and cotton rags and flax waste and sweepings are still used for fine papers. The finest writing papers are made altogether of linen rags, old rags for the softer papers, new linen rags and waste for bond paper. The best tissue papers are made of hemp and rag. Wrapping papers are made of all kinds of fibers—wood pulp, straw, jute, old rope and twine, china grass or ramie fiber, manila hemp (whence the name "manila" paper), and old paper. News-print papers, in countries where wood is plentiful, are made from wood pulp; rags, straw, and esparto grass (a Spanish grass largely used in England) are used elsewhere. Most book papers are now made of wood pulp. Feather-weight papers are made of esparto. Bamboo fiber is an important new source of book paper.

Wood pulps are divided, according to the processes by which they are made, into mechanical or ground pulps and chemical pulps, the latter including pulps

made by the sulphite, soda, and sulphate processes. The soda process is used for poplar, basswood, beech, and other soft deciduous woods, while the grinding, sulphite, and sulphate processes are used for coniferous woods. Whichever the process, the logs (usually from trees 10 to 12 inches in diameter) are cut in 2-foot lengths, barked, and trimmed to remove knots, seams, and decay.

To make ground pulp, the blocks, placed in steel pockets against a revolving grindstone, are held firmly by hydraulic pressure, while water playing on the stone carries away the ground fiber. The pulp in the water is then strained through vibrating screens to remove lumps, and, if necessary, bleached. In some pulp mills the pulp is at once made into paper; in others it is formed into sheets for sale to the papermakers.

To make chemical pulp, the log sections are chipped up and placed in a "digester," where they are cooked for a number of hours in a chemical solution—caustic soda in the soda process, acid sulphite of calcium and magnesium in the sulphite process, and sodium sulphate (which becomes sulphide) in the sulphate process.

There is considerable difference in the quality of the fiber obtained by the different processes. Ground pulp and soda pulp have little strength, but are useful to supplement stronger fibers. Sulphite pulp and sulphate pulp, especially the latter, make strong, tenacious paper. News-print paper is made of a mixture of ground pulp and sulphite pulp.

READING "CHARACTER" IN PAPER

An expert can quickly determine the quality of paper. He reduces the sample to a pulp, treats the fibers with a chemical solution to dye each variety of fiber a different color; then when they are magnified under a microscope, as shown above, the shape and markings of the fibers tell him the whole story. For instance, the dots and lines on these fibers together with their color tell the expert that the paper was made of spruce wood by the sulphite process.

The Making of Paper

The real making of paper begins in the "beater," a huge oval tub furnished with a revolving horizontal roll set with knives like a paddle wheel. The quality of the paper depends on the material furnished the beater, the length of treatment (10 to 12 hours for linen bond, one and a half to three hours for cheap printing papers, and one to one and a half for soft cotton fiber for blotting paper), the character of the knives, and other features of the machine. In the beater, a mineral "filler" (usually china clay or sulphate of lime) or starch is often added, to fill the pores and give weight to the paper. Dyes and rosin sizing are added if desired. The size forms a coat of varnish on the fibers, rendering the finished product less absorbent.

From the beater the pulp or "stock" ordinarily passes through a "refining engine," in which it is still further mixed and beaten. The most common type consists of a cone set with knives revolving in a stationary conical case, the inner surface of which is likewise set with knives, the stock flowing between the cone and the case. It is then screened, thinned, and pumped to the paper machine proper.

The Fourdrinier machine, on which book, news, and writing papers are made, is the same, improved yet essentially unchanged, as that which revolutionized paper manufacture more than a hundred years ago. In this machine the liquid stock flows out on an "apron" of waterproof cloth by which it is spread over an endless belt of fine wire cloth, 60 to 100 feet long, woven with 60 to 90 meshes to the inch, traveling horizontally over many small rollers, through which the water immediately begins to drain away. The belt is given a sidewise shake as it runs, so as to felt the fibers crosswise as well as lengthwise. For news-print the belt may be wide enough to make paper 200 inches wide, running 500 feet or more a minute. For book and writing papers the width is from 60 to 150 inches and the speed 60 to 400 feet a minute. "Wove," "laid," and "watermarked" papers, before leaving the wire belt, pass under a light wire roll called the "dandy," which impresses the proper design upon the paper. For wove paper the dandy has the same number of wires as the belt below. Laid paper has parallel lines about an inch apart crossed at right angles by lines quite close together.

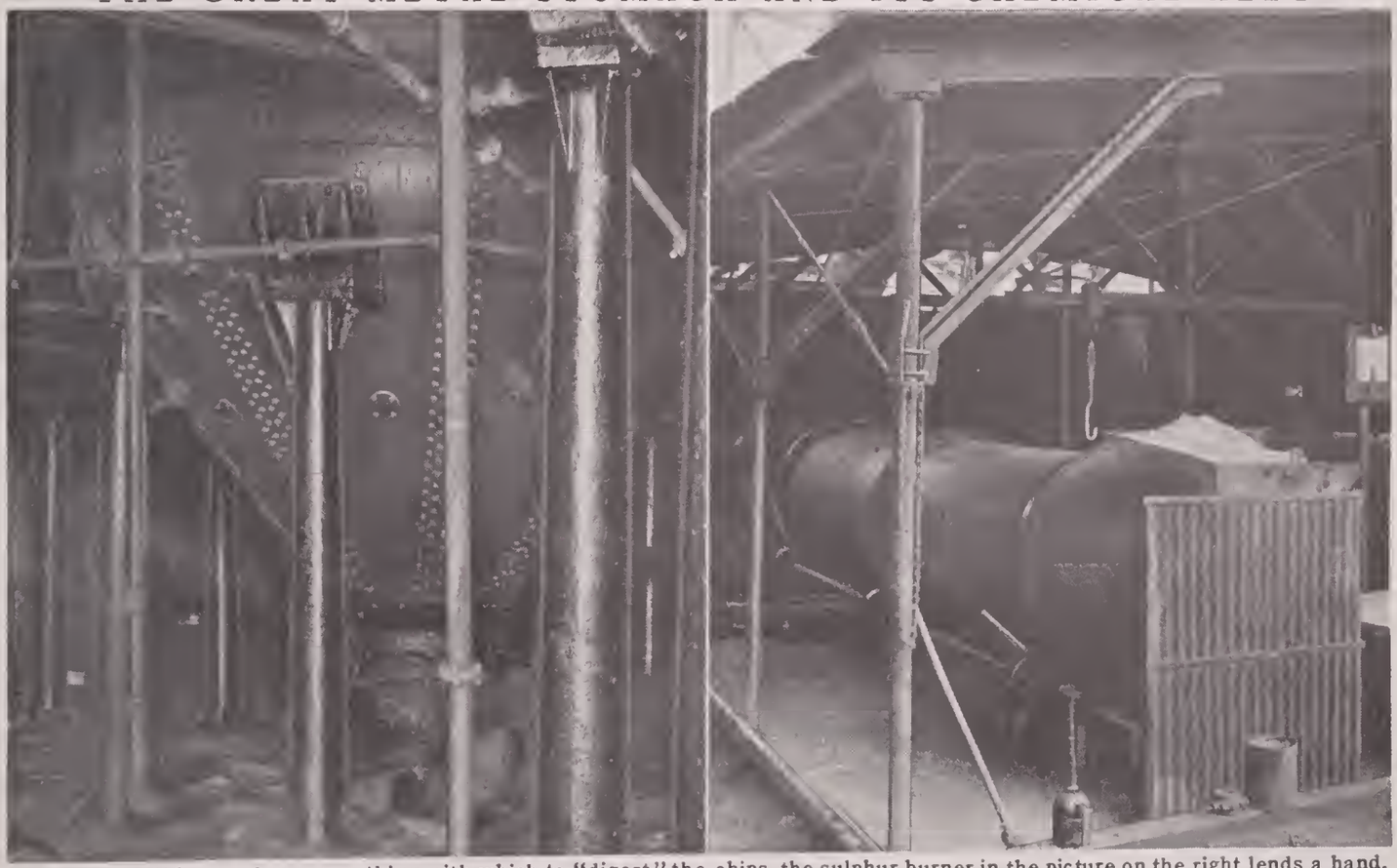
From the wire belt the still moist tender web of paper passes, supported on a belt of felt, through two or three pairs of massive press rolls. From these it runs alternately over and under a number of steam-heated metal cylinders, the "driers." Fine papers may receive at this point a "tub" sizing in a vat of gelatin solution. Next the paper passes through the "calenders," a stack of chilled iron rolls which smooth it, producing a "machine finish." It is then wound on a reel and passes to the "slitter," which trims the rough edges and, if necessary, cuts the roll into two or more narrower ones. News-print is now ready for the printing press. Fine papers for some kinds of book and magazine work may be "supercalendered," or given a hard smooth finish in a supplemental calendering through alternate chilled iron and paper rolls under great pressure; or they may be "coated" with glue or

(*Continued on page 2673*)

HOW TREE TRUNKS ARE TURNED INTO BOOK LEAVES

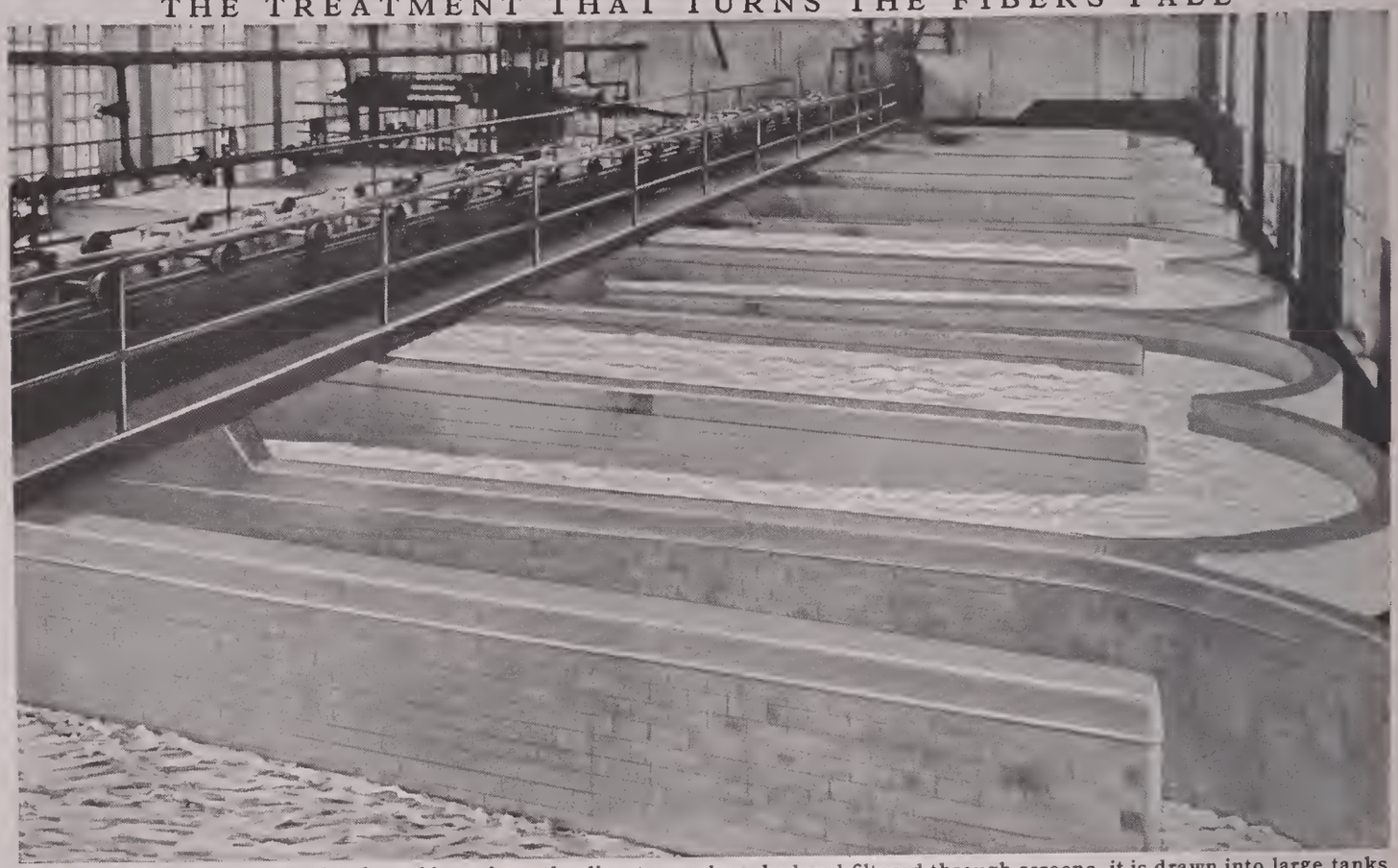
Here are sections of trees starting on their journey to become "educated"—that is, to become paper upon which much interesting information will be impressed. The logs, cut into 2-foot lengths, are barked and trimmed of all undesirable parts and sliced up into small chips. The photograph shows a man sending a log to visit the revolving knives, while a chute carries its chopped-up brothers to the "digester" tank below.

THE GREAT METAL STOMACH AND ITS CHEMICAL ALLY



As this huge tank must have something with which to "digest" the chips, the sulphur burner in the picture on the right lends a hand. It converts sulphur into gas, which travels through a water-cooled pipe into a lime tank. Here the lime and gas combine, forming the sulphite solution (bisulphite of lime). The chips and sulphite go into the "digester" and steam is forced in. When the chips have cooked several hours in the solution, all impurities are dissolved and the fibers separated.

THE TREATMENT THAT TURNS THE FIBERS PALE



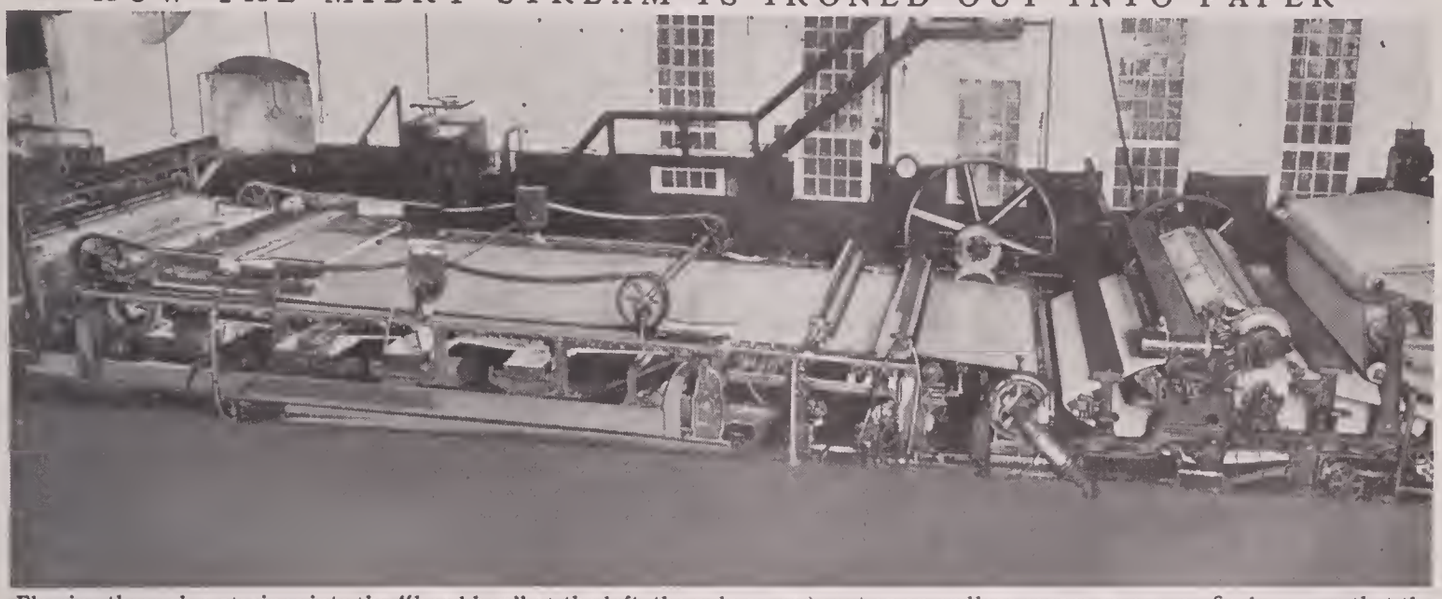
After the thick creamy mass has been blown from the digester, and washed and filtered through screens, it is drawn into large tanks called "bleachers." These are filled with a solution of bleaching powder, which blanches the pulp to a milky white. It now receives another of its many washings and is ready for the next step.

HERE QUALITY IS BEATEN INTO THE PULP

Let us visit a modern "beater" room, where the actual making of paper begins. The sacks at our left contain china clay, which fills up the pores of the paper. Other containers are filled with sizing, used for hard finish stock, and with coloring matter, for making tinted paper. The pulp is piped into the oval beater vats and mixed with the necessary amount of clay and other ingredients. A revolving paddle wheel, having knives for its paddles, further separates the fibers while it mixes the ingredients. The longer the beating the better the paper.

For any subject not found in its alphabetical place see information

HOW THE MILKY STREAM IS IRONED OUT INTO PAPER



Flowing through a strainer into the "head box" at the left, the pulp spreads out on an endless copper screen, so finely woven that the fibers remain while the water drains off. This screen moves forward with a side-to-side motion, which settles the fibers and knits them together. Look at the first roller toward the right; it is a suction roller, and extracts excess water as the pulp passes over it. The moist fibers now advance between blankets of wool felt to a series of brass rollers. And here real paper begins to appear. The rollers squeeze out the remaining moisture and incorporate the fibers into a continuous sheet of paper, then pass it on between a long row of steam-heated metal rollers, pictured in the lower photograph, which dry and harden it as it progresses.

THE PATH OF THE GREAT WHITE RIBBON

If you were to start from the wet end of the machine, shown in the upper left-hand corner, and leisurely walk the length of the machine, you would be keeping abreast of the same mass of pulp, and you would learn how really short a time it takes for the marvelous Fourdrinier machine to iron the milky stream out into beautiful fine-textured paper such as you see in the large photograph.

contained in the Easy Reference Fact-Index at the end of this work

WHERE THE ROLLS BECOME SHEETS FOR THE PRINTING PRESSES

A busy paper mill must make good use of its time. The upper picture shows us four rolls being cut at one time by each machine. The paper is automatically fed to a roller whose circumference is equal to the length of sheet ordered. A knife is attached to the roller, and at each revolution the long blade cuts four sheets. These are carefully inspected for defects and packed, and then—well, perhaps you are looking at one of these sheets right this minute!

For any subject not found in its alphabetical place see information

casein and china clay or some other mineral which gives a smooth surface, but softer than that of super-calendered papers. Glazed papers of the type used for covering paper boxes are given a very glossy finish by calendering in a machine where a top roll of hot iron revolves much faster than the roll below.

Cardboard, strawboard, binders' board, building board, heavy papers, and most tissue papers are made on various modifications of the Fourdrinier machine. In one of the most important of these, known as the cylinder machine, the wire cloth is fastened around a cylinder which revolves in the vat of pulp stock, taking up a layer with each revolution. Machines for making heavy boards are so arranged that the sheets from several cylinders meet and are pressed together as they leave the wire cloth. The course of the paper or board after it leaves the cylinder is similar to that of paper made on the Fourdrinier machine.

It takes more than five million cords of pulpwood each year to supply the paper needs of the United States. If these logs were piled in cord lots placed end to end they would make one gigantic pile more than 8,000 miles long—more than enough to belt the earth at the Equator. This means the annual cutting of hundreds of thousands of acres of timberland. The paper shortage during the World War was a forcible reminder of the condition which will confront us before long if we do not provide for the future. The waste from the lumber industry is one important but neglected source of supply. While wood pulp remains the cheapest and most readily available material up to the present, probably necessity will drive us to the utilization of other plant fibers in its place.

The very thin, tough, and opaque paper called "Bible paper," the best known type of which is the Oxford India paper, is made of linen rags with starch or minerals added to give opacity. The very strong translucent "parchment paper" used to protect the corks of toilet preparations and for other purposes is made by dipping ordinary unsized paper into sulphuric acid and quickly washing out the acid. "Waxed paper" is passed through a machine that coats it with melted paraffin. Most so-called "rice paper" is not, properly speaking, a paper but a natural tissue derived from the pith of a small Formosan tree; and it has nothing to do with rice. It is used for the manufacture of artificial flowers, for the painting of small pictures, and for the manufacture of sun hats. But paper made from rice straw is also called "rice paper."

Kraft paper is a very tough dark-brown paper made by digesting wood chips by sodium sulphate. It is much used for making heavy sacks for grain and flour, for wrapping paper, and for a sort of twine made by rolling in narrow strips. Roofing and building papers are made from all sorts of coarse and cheap materials, usually impregnated with asphaltic substances.

Paper is made in a great variety of sizes. Most newsprint is made in rolls, varying in width from 30 inches to 75. The principal sizes of sheets are named thus: antiquarian, 31 x 53; cap, 13 x 17; double cap, 17 x 28; legal cap, 13 x 16; columbier, 23 x 34; crown, 15 x 19; demy, 16 x 21; double demy, 16 x 42; elephant, 23 x 25; folio, 17 x 24; foolscap, 12½ x 16; double folio, 22 x 34; legal foolscap, 8 x 24; letter, 8 x 10; note, 5 x 8; commercial post, 11 x 17; royal, 19 x 24; super-royal, 20 x 28.

Papier-mâché (*pä-pyā′ mä-shā′*). When paper pulp mixed with glue, paste, oil, rosin, or other sizing is dried in a mold under pressure, a tough plastic product resembling wood results. This is called *papier-mâché*, which is French for "pulped paper." If you look around your home you will doubtless find that many common articles are of papier-mâché—boxes, vases, trays, lacquer-ware, light articles of furniture, architectural adornments, and numerous household utensils, such as pails and tubs. Its most important use is as a mold for the stereotype plates from which newspapers are printed, though it has been used for many other purposes, including doors and car-wheels.

In addition to the kind made directly from paper pulp, papier-mâché is also made from sheets of thick millboard, which are heavily pressed, and from sheets of paper. In making this last kind, a number of sheets are saturated with water, and then pressed into a mold. The articles thus formed are then dried by heat and dipped into a mixture of linseed oil and tar, then baked, trimmed, planed, and painted with several coats of tar and lampblack. Finally, they are varnished, lacquered, and polished ready for the market.

Papineau (*pä-pē-nō′*), Louis Joseph (1786–1871). From the year 1808, when he entered the assembly of Lower Canada (Quebec), until 1837, when he fathered a short-lived and disastrous revolt of French Canadian peasants against British rule, Louis Papineau was the stormy petrel of Lower Canada politics. His aim was not merely a reform of the existing government, which then gave the British minority a monopoly of offices and power, but perhaps also the complete independence of French Canada.

As speaker of the assembly for nearly the whole of this period, Papineau was a continual thorn in the side of the council and the British governors, one of whom resigned (1827) rather than confirm his election to the speakership. By his fiery eloquence he fanned the flames of racial suspicion and hatred between French and English in Lower Canada. Matters at last came to a head when the assembly for several years refused supplies to the governor and other officials, as a means of forcing the government to make the legislative council elective. When this concession was denied, there was an outburst of resentment which culminated in 1837 in a series of risings by the "Sons of Liberty," as the revolutionists called themselves. But the soldiery made short work of the poorly armed and unorganized peasants, and Papineau saved himself by fleeing to the United States, where he remained for two years, and later to France.

After the amnesty of 1847, Papineau returned to Canada. He was elected to a seat in the then united parliament, and again continued to agitate for the separation of Upper and Lower Canada. But the idol of the French Canadians had fallen; Papineau's influence was gone, and he soon retired to spend the remainder of his long life in seclusion.

PAPY'RUS PLANT. This reed (*Cyperus papyrus*) was widely cultivated in ancient times in the Delta of Egypt, where it was used for many purposes, especially for a species of paper prepared from the pith. It grows from three to ten feet high, with long sharp-keeled leaves, and soft naked stems as thick as a man's arm at their lower part; it is topped by numerous long drooping spikelets. The more slender stalks were woven into baskets, and the thicker ones, tied into bundles, were made into light boats. The fiber furnished material for cordage, sails, awnings, and matting. The pith, besides being used for paper, was eaten raw or boiled by the poorer classes. The root was dried and used for fuel and in the manufacture of utensils. The papyrus plant is now extinct in Lower Egypt, but still grows in the Upper Nile regions and in Abyssinia. (*See* Paper.)

PAR'ACHUTE. Hold an unfolded umbrella high above your head and try to pull it down quickly. You will find it difficult because the air offers so much resistance. This same resistance enables the parachute used by an aviator, which looks and acts very much like a giant umbrella, to "protect against a fall," which is the meaning of the name. The parachute is the great life-saver of the balloonist and the aviator, often providing the only means of escape when the air-craft catches fire or is otherwise disabled in air. Successful descents have been made from heights of five miles and over. Small parachutes are also used in war to drop messengers to points where an airplane cannot land.

Parachutes are made of canvas or some other stout fabric, from which a basket or harness is suspended by cords. They generally have a hole at the top to allow some of the air to pass out and thus prevent violent swinging back and forth. One-man parachutes are about 16 feet in diameter; parachutes for enabling two at a time to descend are 20 feet or more in diameter. Much smaller parachutes are made for dropping bags of mail from postal aircraft. Tiny parachutes are fitted to star shells to retard the drop of their lights, thus giving a comparatively long period of illumination. Such star shells were used in great numbers during the World War to illuminate enemy trenches at night and to detect the position of hostile vessels.

LEAVING THE PLANE IN MID-AIR

This shows a test made to determine the value of parachutes as life-savers in case of airplane accidents. The parachute jumper climbed out upon the wings and released the small parachute, which in turn dragged the big one out of the case strapped on his back. We see him just as the rush of the wind has pulled him from the plane. In another second the big parachute will open and float him safely to the ground. In practical use, the parachutes are arranged to open and pull the flyers from their seats if the plane falls.

When attached to balloon or airship, parachutes are folded. They are automatically opened by the air as the descent begins. A development of the World War, when hundreds of lives were saved by parachutes, was a folded parachute which is released when the airman presses a spring. The speed of the airplane causes it to be opened instantly by air pressure; and cords attached to the harness he wears jerks the airman from his seat.

In March 1921, Lieutenant Hamilton of the United States Army made a parachute descent of more than 24,000 feet at Chanute Field in Illinois.

PARADISE BIRDS. Gorgeous wingless and legless birds that floated through the air sustained only by their ample plumes and that died if they touched the earth! Such is the description of these tropical birds of Australasian regions, given by the early Dutch explorers, the first Europeans to see them in the freedom of their wild state. They believed that the brilliant rainbow plumage of the birds could not have been grown amid earthly surroundings, and they declared that they were "birds-of-the-gods," fed from the dews of heaven and the nectar of flowers.

As proof of their statement that the birds lived entirely in the air, the travelers displayed two cured skins given them by the natives. From these skins the wings and feet had so skilfully been removed that the great naturalist Linnaeus himself did not detect the trick, for he named the principal species the *apoda*, that is, the "footless" bird. Many years passed before the truth about these beautiful creatures was commonly known. Naturalists have now studied them in their native haunts, and while finding them quite worthy of the extravagance of their name, have related them to no more heavenly group than that of our common crow!

There are about 50 species of birds of paradise, all confined to the tropical islands of the Pacific. They range in the size of their bodies from that of a crow to a sparrow, and each species has its own brilliant feather characteristic.

The "great emerald" paradise bird is a changeable purple beneath, with head and neck of pale yellow, and forehead, cheeks, and throat of metallic green. Beneath his wings are tufts of delicate golden-orange feathers, which when the wings are raised fall over

THE GODDESS AND THE "GUARDIAN ANGEL"

A strange thing about parachutes is that the further you fall, the safer you are. That's because a parachute must have time to open. To prove the effectiveness of a new model of quick-opening parachute, Major T. Orde Lees of the British Air Force jumped from a seaplane flying only 300 feet above the water off the Statue of Liberty. You see him in the drawing, just as he has struck the water and launches are speeding to fetch him ashore. This type of parachute, known as "The Guardian Angel," proved a great success. Parachutes often fall as much as 500 feet before opening.

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him like the spray of an electrical fountain. The "red" paradise bird has similar tufts of crimson, and in addition has elegantly curling tail feathers 21 inches long. The "superb" paradise bird has on his neck a strange feather-shield which he can spread about his head, in a gorgeous fanlike circle.

Nature gives the mother-bird a plain dull dress; otherwise how could she hide her nesting place from preying man and animal? The nest is placed in tall trees, where she takes entire care of the two or three eggs, and of the babies after they are hatched. During this period the handsome father-bird must keep far away from home, lest his showy plumage betray the hiding place and the baby birds be taken.

The male bird is usually very wary, but during the mating season his vanity is often his destruction. For then the male birds congregate, sometimes as many as 20 in one tree, and display their fine feathers before a coquettish female, hoping to win her as mate. This is the hunter's chance, for the birds are so interested in their "style show" that they may then be shot at close range by the blunt arrows which hunters use in place of bullets, in order that the skin may not be injured.

Birds-of-paradise feathers are in great demand for hat trimmings. However, the high tariff placed upon them now almost prohibits their importation into the markets of the United States. Other countries also are moving to check the slaughter of these most showy members of the bird kingdom. Living birds of paradise may be seen only in their natural homes, as they soon die in captivity.

Scientific name of great emerald bird of paradise, *Paradisea apoda;* of the red, *Paradisea sanguinea;* of the superb, *Lophorhina superba.*

PARAFFIN. In 1830 a German chemist obtained a white waxlike substance from wood-tar and named it "paraffin," from the Latin, on account of its refusal to unite with most other substances. It is now used for the making of candles, in sealing jelly glasses, in the laundry, for waterproofing, and many other purposes. In 1885 the great Egyptian obelisk in Central Park, New York, was coated with paraffin, and it has since resisted the disintegrating effects of the weather. Paraffin is now usually obtained in distilling petroleum (*see* Petroleum).

PAR'AGUAY. No South American state has a more romantic and tragic history than this little inland republic. It is the only one on that continent which has never had a seaboard, the smallest in population, and the third smallest in territory. Although blessed by nature with such exquisite beauty and so delightful a winter climate that it has been called the Riviera of South America, its history has been a tale of suffering almost without parallel. It was crushed under the heel of Spanish despotism for two centuries; and gained its independence only to fall under the yoke of a trio of military dictators, who ruled it with a rod of iron. The last of these plunged it into a war which ranks as one of the bloodiest and most disastrous in history, in comparison with the population involved. So phenomenal were the losses in battle and from privation that five-sixths of the entire population (two-thirds according to other authorities) perished during the five years of the war, from 1865 to 1870. And even in later times fate has continued to deal unkindly with the Paraguayans, for civil wars have devastated the land at frequent intervals. Between 1904 and 1912 there were six of these conflicts, costing the country 30 per cent of its people. Even now the female population is several times more numerous than the male.

From the advent of the first dictator in 1814 until 1852, Paraguay was the hermit nation of the Americas. Foreigners were barred from its borders and trade was banned as jealously as in Tibet. Even after the opening of the frontiers, intercourse with other nations was slow in developing, so it may be said that the history of Paraguay as a modern republic does not begin until the adoption of its constitution in 1870.

Paraguay proper is a territory of about 65,000 square miles lying between the Paraguay and Parana rivers. It also claims an area of about 130,000 square miles between the Paraguay and the Pilcomayo, the title to which is disputed by Bolivia. This disputed region is part of the vast plain known as "El Gran Chaco," which here contains extensive pasture lands and forests of valuable woods. It is largely unexplored and inhabited chiefly by wandering Indians. Paraguay proper is a low-lying land of fertile rolling hills and valleys, with dense forests and groves of palms, orange, and banana trees.

THE CAPITAL CITY OF PARAGUAY

Asuncion, the capital of Paraguay, lies on a plain, with hills back of it, and faces upon a curve in the Paraguay river. The most striking building in the city is that big bank on your left, which was formerly a palace.

AMONG THE BIRDS OF PARADISE

Among the most gorgeous of living creatures are the Birds of Paradise, of which there are many species boasting almost every form of feathery ornament and every brilliant hue of the rainbow. In the upper right-hand corner is the Great Bird of Paradise, showing the amazing shower of plumes which spring from beneath his wings. The female of this species, shown just to the left of the middle of the picture, lacks all special decorations. In the upper left-hand corner is the King Bird of Paradise, while the little creature with the light-colored ruffle on his back is the Magnificent Bird of Paradise. Curiously enough, the Crow down there in the corner is a close relative of the Paradise family, far closer, indeed, than the Lyre-Bird in the other corner, despite the fact that the latter would seem more suited to this gorgeous company.

A PATCH OF BLACK IN A RIOT OF COLOR

OF course, in Birdland, the saying "Clothes make the man" would have to be translated "Feathers make the bird." And the translation would be just as far from the truth as the original. For example, just look at our old friend Jim Crow, in the group on the back of this page, like Hamlet in his "customary suit of solemn black." Who would suppose to look at him that he is not only a relation but the nearest relation of those resplendent Birds of Paradise? Yet it is true! On the other hand that Lyre-Bird, whose taste in dress is as striking as any in Birdland, is only a very distant relation! In Birdland, relation is determined not by the dress, but, among other things, by a kind of "palmistry," the character of the feet; "physiognomy," the character of the bill; anatomy, the shape of the bones. The Crows and the Birds of Paradise belong to the order of the *Passeres*, or Perching Birds. This order is so large that it takes in more than half the living birds and includes 7,000 species and sub-species, ranging from crows to titmice, and including the sparrows, after whom the order is named, from the Latin word *passer* which means "sparrow." Yet the Lyre-Birds can barely claim this broad relation, for according to the specialists in Birdology—otherwise, Ornithology—the Lyre-Birds cannot be assigned to either of the two leading groups into which the Passerines are divided, but must be regarded as standing to a great extent by themselves and so are put into a Passerine group of their own, the *Menuridae*. And you might suppose the Lyre-Birds themselves were in some doubt as to just what kind of birds they are, for they are constantly imitating the cries and songs of other birds. And they are particularly good at it too!

The soil is rich and under cultivation produces abundant crops of wheat, corn, cotton, sugar cane, rice, tobacco, and fruits. But the chief agricultural industry so far has been the gathering and cultivation of *yerba* or *herba maté*, "Paraguayan tea," which furnishes the favorite beverage of South America. Next in importance is the cattle industry, which supplies hides for export and meat for the meat-extract and jerked beef factories. Oranges grow almost everywhere, in such abundance that though most Paraguayans eat 20 or 30 a day, only a part of the crop can be used. Great quantities are exported to Argentina and Uruguay. They are used in the Parana valley for feeding hogs. The extraction of "petitgrain oil" from orange leaves is a growing industry. The most valuable forest product is *quebracho* timber, which is far superior to any other wood as a source of tannin.

One of Paraguay's great needs is railway development. Less than 300 miles have been constructed; and where the waters of the great rivers are not available for transportation, everything has to be carried in bullock carts over wretched trails of deep dust in dry seasons and almost impassable bogs in rainy weather.

The population, which numbers about a million, contains a smaller European element than any other South American state. The percentage of white blood in most of the people is small. Like their ancestors the Guarani Indians, the Paraguayans are an easy-going, light-hearted race, with a strain of wildness that sometimes manifests itself in volcanic outbreaks of passion. The Guarani language is spoken more generally than Spanish. Italians form the bulk of the newcomers, with Germans second. Education is backward; schools are few and poor, and the majority of the population is illiterate.

The capital and chief city is Asuncion (population, about 100,000), near the center of the country on the Paraguay River. Villa Rica (30,000), about 90 miles southeast, on the main railway line to Buenos Aires, is an important shipping point. Villa Concepcion (25,000), lying at the head of navigation for large vessels on the Paraguay River, is another commercial center.

Asuncion was founded in 1535 by Juan de Ayolas, who ascended the Paraguay seeking a route to the wealth of Peru. In the 17th century Jesuits founded about 30 communities, which they ruled until their expulsion in 1768. The Paraguayans declared their independence from Spain in 1811, and then fell into the merciless hands of the dictator José Gaspar Rodriguez da Francia, who built up a powerful army and closed the frontiers to foreigners. He was succeeded in 1840 by another despot, Carlos Antonio Lopez. Under his son, Francisco Solano Lopez, who came into power in 1862, Paraguay had a larger population than Argentina or Brazil, with the strongest army on the continent. He fell a prey to wild ambition and to militarism, for he provoked a war with Argentina, Brazil, and Uruguay, which ended in 1870 with his own death. In his final retreat this mad despot razed every town in his line of march and slaughtered every animal, leaving the country in a state of pitiable desolation. Paraguay even yet has not recovered from the effects of this terrible war. During the World War of 1914–18 Paraguay remained neutral. (For map, *see* Uruguay.)

"LOAFERS" *of the* ANIMAL *and* PLANT WORLDS

How Some Creatures Live on Other Creatures' Earnings—The Big Fleas and the Lesser Fleas, and "So Ad Infinitum"—The Ways of the Parasites—Difference between "Parasitism" and "Symbiosis"

PARASITES. When we see some grown healthy boy living at the expense of his hard-working father and mother, while he himself does nothing at all, we say: "Oh, he's no good; he's just a parasite." And so in the animal or plant kingdom whenever a creature lives at the expense of another, we call that creature a parasite, and his way of life "parasitism."

A considerable proportion of both plants and animals live partly or entirely by attaching themselves to other living things. All living animals, great or small, are liable to the attacks of the unwelcome visitors. Man is no exception. More than 150 distinct species of parasites may infest his blood, muscles, glands—in fact, almost every organ and tissue in his body. The most dangerous of human parasites are the disease-producing germs, which are responsible for such deadly ills as tuberculosis, malaria, diphtheria, typhoid, and sleeping sickness (*see* Germ Theory of Disease).

The number of parasites harbored by one host may be enormous. Several million have been found in a single horse. About 40 different kinds of parasites infest the dog; cattle and pigs have more. At least 20 kinds of parasites accompany the frog on his watery way. Even the great thick hide of the rhinoceros does not protect him from the tick. Birds and quadrupeds, fishes and whales, even insects, are all the unwilling hosts for myriads of smaller creatures. You remember the old rhyme:

'Tis said that fleas have lesser fleas
Upon their backs to bite 'em,
And these in turn have lesser still,
And so ad infinitum.

Even the tiny protozoa, the one-celled animals so small that we can see them only by the aid of a high-powered compound microscope, have smaller protozoa living on them!

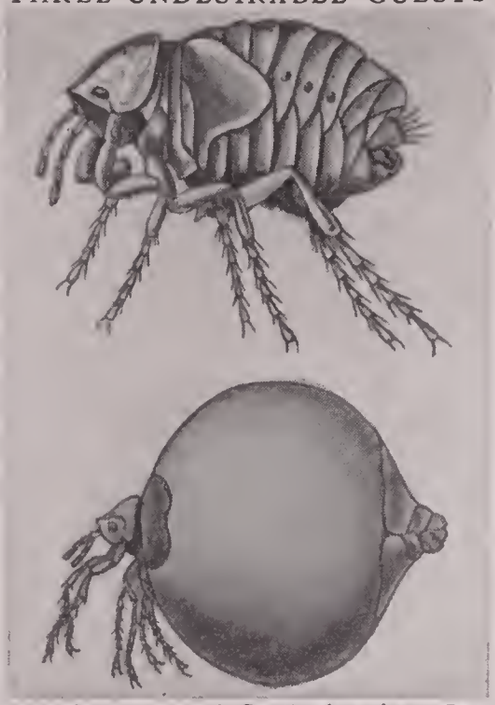
We are all familiar with certain kinds of parasites. The famous "cooties," or body lice which infested

soldiers during the World War, often conveying the germs of typhus fever, are good examples. So too are the many other kinds of lice that live upon the bodies of man and other animals, and such insect pests as the jigger or chigger (a minute insect which burrows under the skin), mosquito, and bedbug. The parasite usually gets not only its food from its host, but also warmth and protection as well. And the parasite usually does nothing for its host in return. In fact it often injures its host, and if present in great enough numbers actually causes its death.

Parasites live on the outside of the bodies of plants and animals, and very often inside as well. Examples of external parasites are the lice, fleas, and ticks of animals, and the plant lice and scale insects of plants. Some parasites live for their whole lifetime on the body of the host. Such parasites are called permanent parasites. The bird lice are permanent parasites. Their eggs are laid on the feathers of the birds, and the young descend to the skin when they hatch. But fleas are of a different sort. They often leap off from the body of the host, and may even go to some other host. Such parasites are called temporary parasites.

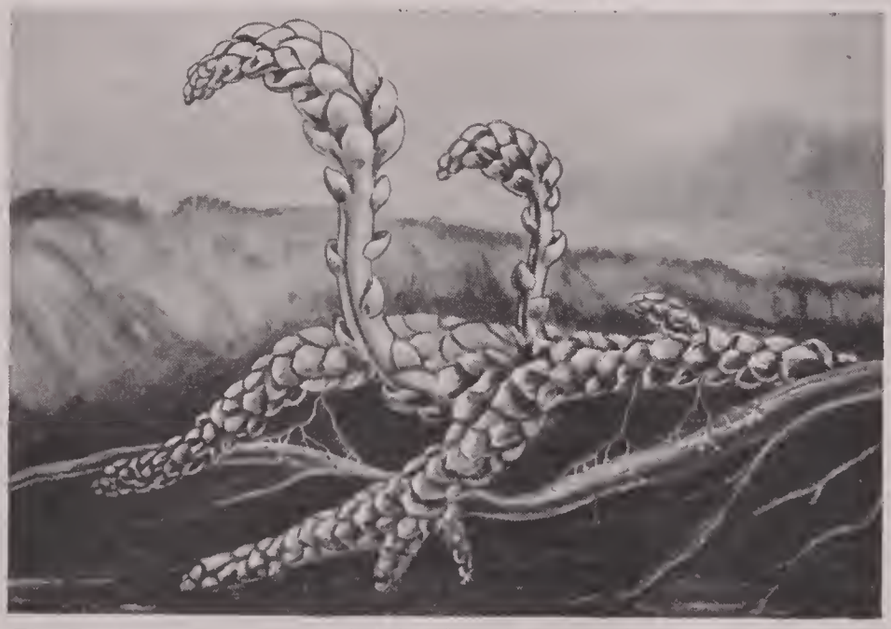
Some of the internal parasites most familiar to us are those that live within the human body. The most common of these is the tapeworm. It lives in the intestines and eats the food which ought to go to nourish the person. Too many of these may cause death. The hookworm and trichina are other internal parasites of man which cause disease (*see* Hookworm; Worms).

THREE UNDESIRABLE GUESTS



This is a type of South American flea called a "Chigoe" or "Jigger," before and after it has burrowed under the human skin. The same name applies also to a form of mite with similar habits, common in the United States.

The Lamprey is one of the worst of parasites, clinging to other fish with its cup-shaped mouth, and sucking their blood.



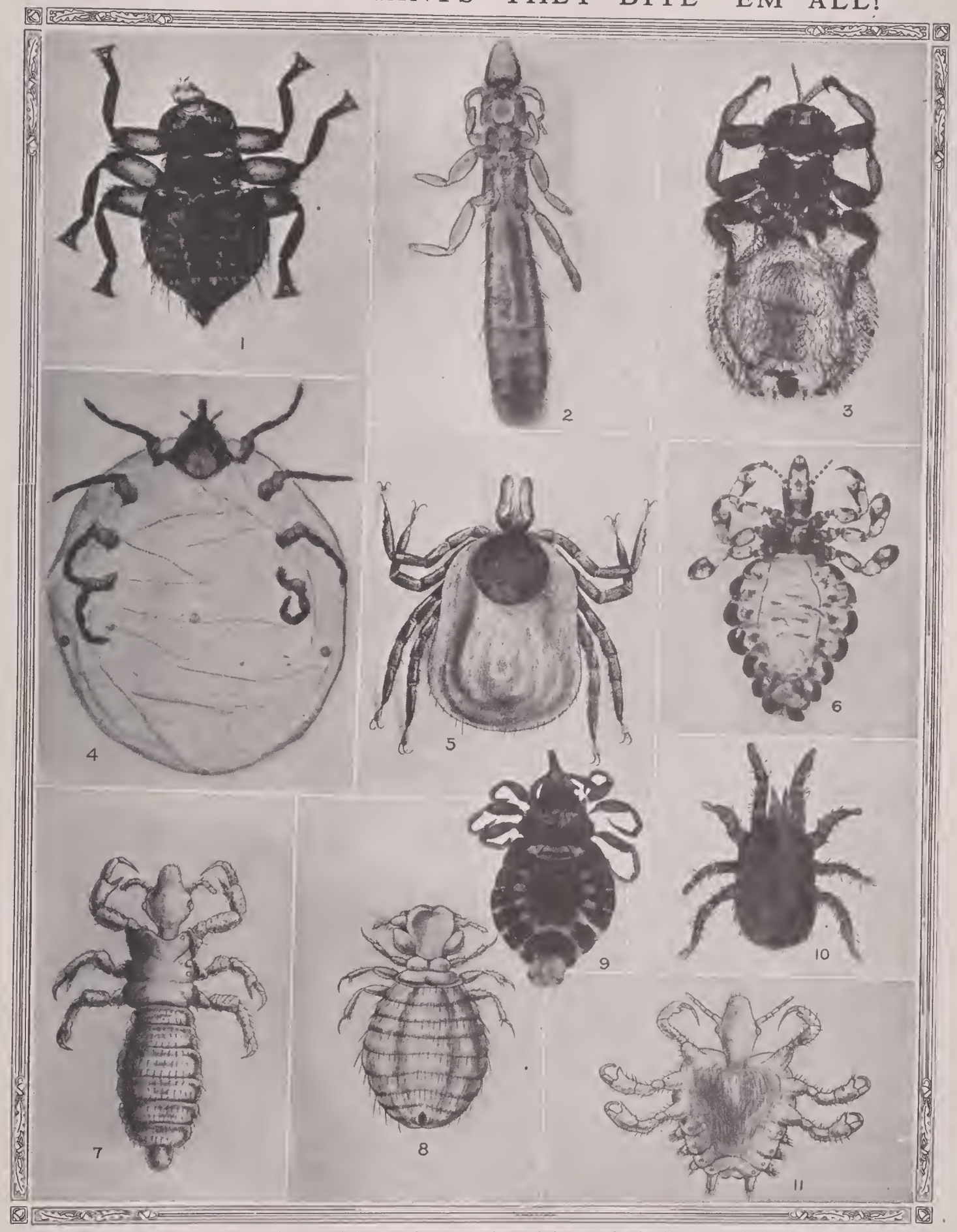
The Toothwort not only attaches itself to the roots of other plants but kills and digests small insects which venture to explore its leaves.

It often happens that the young of certain animal parasites are provided with a full outfit of legs, but soon they settle down and lose their legs. The legs are absorbed just like a pollywog's tail when he turns into a frog; and so during the rest of its useless life the parasite just sits attached to its host and eats and eats, and finally lays its eggs and dies.

The sacculina, which lives attached to certain kinds of crabs, is one of this kind of parasite. Not only does this creature lose its legs, but everything else that would make it look like an animal, and becomes a mere bag for holding nourishment, and a series of branches to penetrate the crab's body and suck its juices up. Such a loss of parts is called degeneration.

All internal parasites are greatly degenerated. You might say that they have shirked the struggle for existence, seeking a sheltered and easy life on the lowest possible terms; and so, according to the law of nature that an organ or function which is not used is lost, they have lost many powers which their ancestors once had. Many parasites which live firmly attached to their hosts have no legs or wings; and since they do not need to see their way about or watch out for food and enemies, they have also lost their eyes, ears, feelers, and other sense organs. Their food is pre-digested by their host, and so they have very simple alimentary

BEES TO ELEPHANTS—THEY BITE 'EM ALL!



This is an enlarged portrait gallery of some of the prominent members of the parasite family of evil distinction. No. 1 is the Bee parasite. No. 2 will have nothing but Pigeon. The taste of No. 3 runs to mutton, for he is the Sheep Tick. No. 4 boards on the Tawny Owl. No. 5 dines regularly on Fallow Deer. No. 6 enjoys pork, for he's the parasite of the Pig. No. 7 is the Body Louse, otherwise the "Cootie." No. 8 makes life miserable for Dogs, while No. 9 penetrates the armor-like hide of the Elephant. No. 11 is the Louse that lives on the Crab. No. 10 is the only one in the whole pestiferous group of whom a good word might be said, for he is the parasite of the House Fly. More power to him!

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canals or no canals at all. So, too, their organs of respiration and circulation have degenerated, and they have become dull inert creatures at the lowest level of life.

Most of the animal parasites are found among the invertebrates, that is, the animals without a backbone, though there are a few backboned parasites. The hag fishes or borers are long eel-like creatures which attack and eat larger fishes, remaining attached to the victim and being carried around with it while they are feasting on the muscles. The lamprey is another fish parasite which sucks the blood of its host.

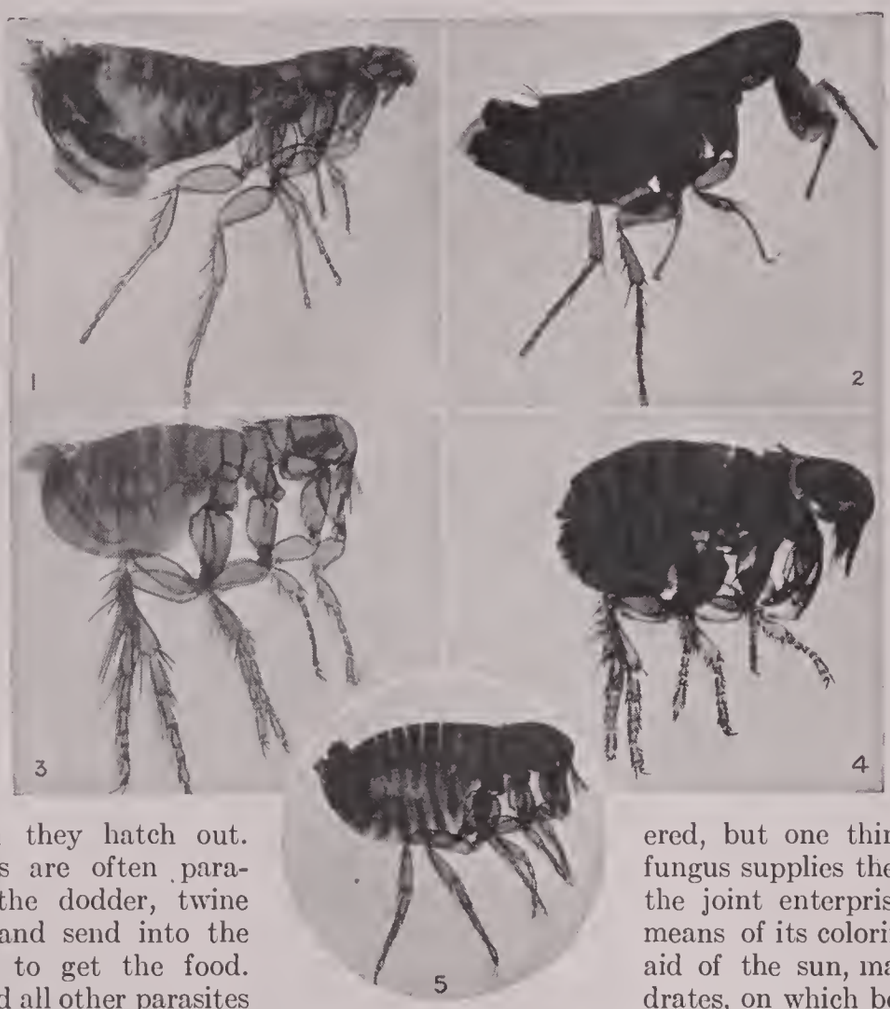
The best known parasites on plants are the scale insects, which attack especially citrus fruits like the orange, grapefruit, and lemon, as well as the bark of fruit trees (*see* Scale Insects). Other parasites on plants lay their eggs in the plant tissues, and the young live and feed at the expense of the plant when they hatch out.

Plants themselves are often parasites. Some, like the dodder, twine about other plants and send into the host little suckers to get the food. Thus the dodder and all other parasites like it are dependent on the host both for food and support. The lovely mistletoe, which we like so much at Christmas, is a parasite on oak trees in the Southern states (*see* Mistletoe). A great many of the fungi, particularly the shelf or bracket fungi that grow on trees, are parasites. These finally may cause the death of their host, the tree, if they become numerous enough. The damage done by parasites, both plant and animal, is enormous. Rusts, smuts, blights, mildews, and various rots are among the most dreaded foes of the farmer, which are kept in check only by spraying and other preventive measures.

Not all parasites, however, are injurious to man's interests. That terrible pest the tussock moth is kept in check only by the 20 kinds of insects whose larvae live in the young moth and so destroy it. Many other injurious insects are kept under control by their special parasites, and nearly all the important insect pests in the United States are insects which have been brought from other lands without the parasites that keep them down in their native haunts.

The difference between "parasitism" and what is called "symbiosis" is the difference between "sponging" on a friend, and going into partnership with him. The most interesting case of symbiosis is the partnership between a fungus and an alga, which makes the lichen. This seems to be an instance where twice one equals one; for the alga is one kind of plant, and the fungus another, and yet when they are added together, they make one thing—the lichen (*see* Lichen). This curious kind of partnership exists in other groups of plants, but was first discovered in the lichens. Exactly what are the business relations of the alga and the fungus has not been fully discovered, but one thing we know, that the fungus supplies the water and salts for the joint enterprise, and the alga, by means of its coloring matter, with the aid of the sun, manufactures carbohydrates, on which both partners live.

FLEAS AND THEIR FANCIES



No. 1 is a Flea that goes about a great deal at night for he is much attached to the Great Noctule Bat. No. 2 also lives in a world of darkness, but that's because he spends his time underground with the Mole. No. 3 leads a lonely existence on the Hedgehog. No. 4 lives a life of luxury under the fur of the Rabbit. No. 5 is the Common Flea, who makes himself at home both on Dogs and on their masters.

Paris. Before the birth of Paris, the beautiful son of King Priam of Troy, his mother Hecuba dreamed that she had brought forth a firebrand. This being interpreted to mean that the child would grow up to bring about the destruction of Troy, he was exposed on Mount Ida. Rescued by a shepherd and reared to manhood, he fell in love with the nymph Oenone, daughter of a river god. But he deserted her when the goddess Aphrodite promised him the fairest woman in the world for his wife, in return for awarding her the golden apple (*see* Trojan War). He carried off Helen, thus bringing on the Trojan War. He himself was wounded in the conflict, and then returned to his long abandoned love Oenone. She refused to heal the wound, and he died. Oenone, repenting too late, then put an end to her own life.

PARIS— *the* QUEEN *of* CULTURE *and the* SOUL *of* FRANCE

From the balcony of the Cathedral of Notre Dame we are looking across Paris toward Montmartre, that hill there in the distance. Rising in the middle of the view is the Tower of St. Jacques, formerly part of a church, but now used as a municipal observatory.

PARIS, FRANCE. If you should ask the western world to vote on the question: "What is the most charming city in the world?" the vote would surely be for Paris, the capital of France and the world's third city in point of size.

For hundreds of years Paris has decided for us what is beautiful. Painting, sculpture, architecture, all the arts in fact, are most at home there, and anyone who wants to study them goes to Paris. It is the capital of fashion, and many of the things we think on science, philosophy, and literature also come first from Paris or from London.

It's a gay city too, where nobody is ever in a hurry and where people always have time to sit at little tables on the sidewalks drinking coffee and chatting. And it's a "free city." Anyone can do anything there, so long as he does not interfere with his neighbors.

The streets and the buildings are beautiful and clean. It is not a great manufacturing center, so there is very little smoke and the streets are washed with water and swept with brooms every day. The Seine River flows curving through the city, crossed by more than 30 beautiful bridges.

THE GREAT ARCH OF TRIUMPH

The Arc de Triomphe de l'Étoile, the largest triumphal arch in the world, commemorates the victories of Napoleon and the soldiers of the Revolution. It stands in the center of the Place de l'Étoile. On the right and left we see two of the four allegorical groups representing 'The Departure for War', 'War', 'Victory', and 'Peace'. Except on gala occasions, such as the celebration of victory after the World War when the troops of the Allies marched through it, the arch is closed to traffic.

The streets do not run parallel, making square blocks, as they do in American cities. Paris is not a "made to order" city; it just grew. Napoleon III, in the second half of the 19th century, made many improvements, but the streets still run every which way, making blocks of all sizes and shapes, like the pieces of a picture puzzle. Every so often a large "place," or open space, has been cut, and broad boulevards have been constructed that go out from it like the points of a star. These boulevards are especially beautiful and are always lined with trees. The houses and buildings are nearly all of light gray stone, never over six stories high. There is a law against building them higher, so that the skyline is different from the jagged line of American cities with their skyscrapers. The public buildings, parks, bridges, are adorned with statues.

For many years one of the striking sights of Paris was the great wall, more than 22 miles long, with 57 gates in it, built between 1840 and 1845, which encircled the city. But at the close of the World War it was decided to demolish the wall and replace it by a continuous circular boulevard.

THE PLACE DE LA CONCORDE FROM ACROSS THE SEINE

This is the finest of all the open spaces of Paris, the Place de la Concorde. That obelisk in the center of the square is from the great temple at Luxor, Upper Egypt, and on either side are two fountains with the decorative sculptural figures so characteristic of French art. The bridge, which is one of the numerous handsome structures across the Seine, is called the Pont de la Concorde. Only pleasure steamers, such as the one we see, and low freight barges, can pass under these bridges. The classic building at the end of the street leading from the bridge—the Rue Royale—is the Madeleine, a church which was built by Napoleon I as a "temple of glory." On the left of the square, we enter the famous Champs Elysées. On the right is the entrance to the historic Gardens of the Tuileries.

On the right or north side of the river are the business districts and the residence districts where the rich people live. The big park, the Bois de Boulogne, where all fashionable people go driving on Sundays, is on this side, and so is the Longchamps race track.

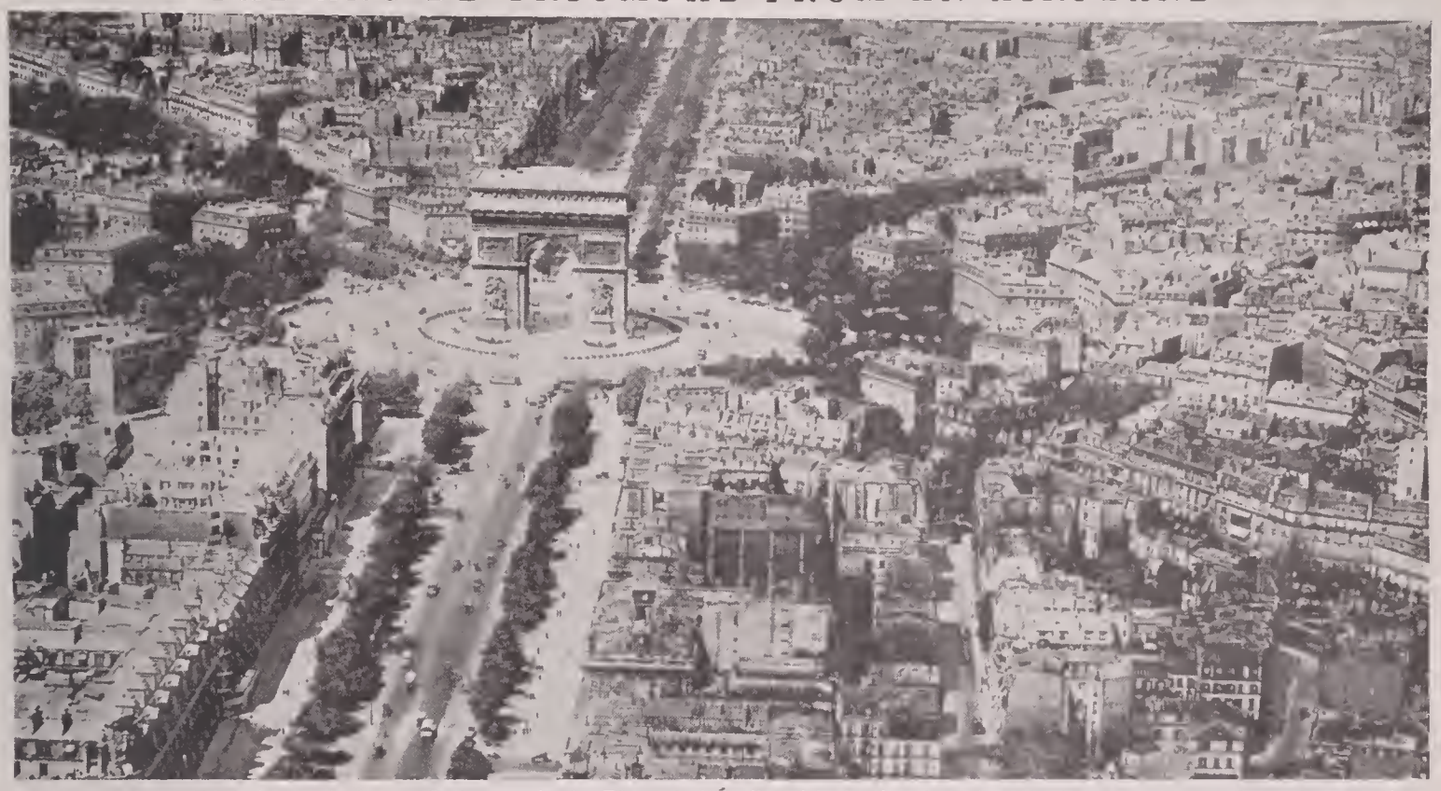
On the left bank is the Latin Quarter. This is so called because the University of Paris is here, and long ago, when education was all given in the Latin language, the students used to go about the streets singing their Latin songs. The students still go about singing, but now their songs are mostly in French. All the artists and students and revolutionaries live in the Latin Quarter to this day; and it's a queer, gay, poor, free place, like no other place in the world.

On an island in the middle of the river, where the original city of Paris once stood, is the cathedral of Nôtre Dame, one of the greatest of Gothic cathedrals, tall and gray and very, very beautiful (for illustration *see* Architecture).

One of the most important places in Paris is the Place de l'Opéra, where the sumptuous Grand Opera House stands. They say that if you sit at a little table on the sidewalk there, and watch the people pass, in course of time you will see everybody in the world. It is very nearly a true saying, for almost everyone who goes abroad is sure first or last to reach the Place de l'Opéra. The Place de la Concorde, where the Egyptian obelisk stands, is where the guillotine stood during the French Revolution. It is here that Marie Antoinette and so many others were beheaded during the Reign of Terror. The mourning wreaths which so long covered the statue symbolizing the city of Strasbourg, in this place, are gone since Alsace-Lorraine is restored to France. The Place de la Bastille, the Place Vendôme, the Place de l'Étoile, and the Place de la Madeleine are also important.

One of the greatest single monuments in Paris is the Arch of Triumph, begun by the great Napoleon "in honor of the victories of France." It stands on a hill at the end of the most beautiful boulevard, the Champs Elysées, or Elysian Fields. Under this arch passed, after the World War, the triumphal procession headed by Marshal Joffre and his guard of the cripples of France. Another monument is the Vendôme column, a bronze pillar with spiral scenes in low relief. The metal for this column came from melting down Russian and Austrian cannon captured in the course of Napoleon's campaign in 1805.

THE ARC DE TRIOMPHE FROM AN AIRPLANE



We are crossing Paris in an airplane. Before us is the Place de l'Étoile with the Arc de Triomphe in the center. From here radiate some of Paris' most famous avenues and boulevards. The street nearest to us, leading to the arch, is the Champs Elysées, which beyond the arch is known as the Avenue de la Grande Armée. Crossing the space diagonally, from the upper left hand corner, is the Avenue du Bois de Boulogne.

THE FRENCH NATIONAL OPERA

The Paris Opéra, before which we are now standing, is perhaps the best known theater in the world, and one of the most beautiful. The front is decorated on the ground story with allegorical groups representing Music, Lyrical Poetry, Lyrical Drama, and Dancing, High against the sky, on the top of the pediment, Apollo, the God of Music, with his uplifted lyre, is seen against the sky. The Opéra is maintained by a government subsidy.

contained in the Easy Reference Fact-Index at the end of this work

Paris has also many palaces—the Louvre, the Palace of the Luxembourg, the Palais Royale, the Palais Bourbon, etc. These used to belong to the kings. Since France has been a republic, they have been, for the most part, public buildings, belonging to the nation or the city. The Louvre is one of the greatest art museums in the world. It is filled with renowned paintings and sculptures, and with collections of Greek, Roman, and Egyptian art. The works of painting and sculpture by living artists are housed in the Luxembourg Palace. For an artist to have his work bought by this museum is the greatest honor that can befall him.

The other palaces are mostly government buildings, where the work of ruling the country is carried on. For, as Paris is the capital of France, the president of the republic, the senate, the chamber of deputies, the different ministries, and the embassies of the foreign nations are all located here.

Paris has also many lovely gardens, two of them, the Tuileries and the gardens of the Luxembourg, being as beautiful as any in the world.

The most famous streets of Paris are the Champs Elysées, the Rue de Rivoli, which has arcades along it for miles, the Rue Royale, the Grands Boulevards, the Boulevard St. Michel in the Latin Quarter (commonly called, in student slang, the "Boul Mich"), the Rue du Faubourg St. Honoré, the Avenue du Bois de Boulogne, the Boulevard St. Germain, and the Boulevard Montparnasse. The most famous churches, aside from the cathedral of Nôtre Dame, are the beautiful Sainte Chapelle, built by Saint Louis in the Middle Ages to hold the crown of thorns and a piece of the "true cross" brought by him from the Holy Land; St. Germain des Près, where Saint Geneviève, the patron saint of Paris, is buried; and the modern churches of the Madeleine and the Panthéon. In the Panthéon many of the eminent men of France are buried. On the hill of Montmartre stands the modern church of the Sacré Coeur, or Sacred Heart. It is built in the form of an oriental mosque, and it can be seen from almost any part of the city.

IN THE LUXEMBOURG GARDENS

We are here looking down one of the beautiful walks in the Jardin du Luxembourg. At the far end we see the building occupied by the French senate.

Other famous spots are the Sorbonne, the largest of the colleges of the University of Paris; the cemetery of Père la Chaise, where many famous people are buried; the Hotel des Invalides, the military museum where stands the tomb of Napoleon (Grant's tomb in New York is patterned after this); the Palais de Justice; the Conciergerie, the old prison that has seen so many tragedies; and the Champs de Mars. In the Champs de Mars is the famous Eiffel Tower, a huge iron structure, nearly 1,000 feet high, completed for the World's Exposition of 1889. Besides being used for making scientific observations and as a wireless station, it is one of the best places to get a view of the city as a whole.

The business of the city is mostly in what are called luxuries—beautiful things that are not really necessary, like jewelry, perfumery, gloves, very expensive dresses, bronzes, and other things. The Bank of France, the center of French finance, is here also. During the World War a number of large factories sprang up on the outskirts of the town, in what they call the "faubourgs" or suburbs, where the poor people

live. In these factories ammunition shells and other munitions were made. They have since been put to other uses, but Paris is still far from being a manufacturing city, in the sense that Birmingham and Manchester and Pittsburgh are manufacturing cities, with their chimneys and clouds of smoke.

The underground railway, the principal means of transportation of Paris, is named the Métropolitain and is called the "Métro" for short. In 1910 the Seine flooded and filled its "tubes" with water.

Paris is a very old city and is full of historical memories. In almost every street and on every place some great man has lived, or some great event has happened. So there is never any end to learning about Paris.

The name "Paris" came from a tribe of early Gauls, called by the Romans *Parisii*, whose mud huts were on the island in the Seine where stands the cathedral. In the time of Christ, Paris was a Roman city named *Lutetia*. In the 4th century it was christened Paris, and in the 10th the counts who ruled it gained the crown of France. From the 12th century the capital was Paris. The kings built many of the beautiful palaces and monuments that made the city what it is, those who did the most for the city being Philip Augustus, Louis XI, Henry IV, and Louis XIV.

Under Napoleon Bonaparte, who came to power after the French Revolution (1789–1795), many new quays, bridges, streets, squares, markets, and public gardens were created. But it was reserved for his nephew Napoleon III (1851–1870) to make Paris the most splendid and beautiful of modern cities. Up to his time Paris still consisted of a labyrinth of crooked and unsanitary little streets. Now great parts of the city were rebuilt, and broad boulevards were constructed to traverse it from north to south and east to west and around the outskirts of the old city. It was the most amazing example of the making over of a city that the world up to that time had seen. Unfortunately financial difficulties delayed the completion of the work; and in the bloody days of the Communist uprising of 1871, following the downfall of Napoleon III and the march of the victorious Germans through the city, much wanton destruction took place. The Vendôme Column erected by Napoleon I was pulled down, and many public and private buildings, including the famous Tuileries palace, were burned by the Red Republicans.

Bombarded during the World War

During the World War the Germans tried to terrorize Paris, repeatedly sending fleets of airplanes and zeppelins to bomb it, and several times they bombarded it with long range cannon that shot 70 miles. They killed many people and destroyed much property, but their bombs and shells did not achieve anything of military importance. The French have since repaired the damage.

The visitor to Paris should not leave without going beyond the low-lying hills which encircle it on all sides and visiting some of the interesting suburbs—St. Cloud, famous for its beautiful shady park and the view it commands of Paris; St. Denis, whose venerable abbey is the burial place of many of the kings of France, especially the Bourbon kings, including the unfortunate Louis XVI and Marie Antoinette; Vincennes, with its ancient castle which was long a state prison; Neuilly, familiar to Americans as the location of one of the best known of American army hospitals during the World War; and Sèvres, where the celebrated Sèvres porcelain is manufactured. Population of Paris, about 2,890,000.

Parker, Sir Gilbert (born 1862). In the early days before he became one of the most popular novelists in the English-speaking countries, Gilbert Parker went from Canada to London to publish a series of stories dealing with Canadian life. But after consulting with a friend, and rereading his manuscript carefully, he felt dissatisfied with his work and burned the stories one by one. The next day he happened to pass a second-hand shop, and saw in the window the uniform of an officer of the time of Wellington and beside it the leather coat and fur cap of a trapper of the Hudson's Bay Company. These objects caught his imagination and brought back memories of his own boyhood, passed on the edge of that wild and romantic region of northern Canada. "At that window," he said, "I commenced to build again upon the ashes of last night's fire. Pretty Pierre, the French half-breed, or rather the original of him as I knew him when a child, looked out of the window at me." Parker went home and began to write the first of the series of stories entitled 'Pierre and His People'.

Gilbert Parker was born at Camden East, Addington, Ontario, and was educated at Trinity College, Toronto. In 1886 he went to Australia and became associate editor of a newspaper in Sydney. After traveling extensively among the South Sea Islands, in Europe, Asia, and Egypt, he settled in London in 1897.

His best novels—among which are 'The Right of Way', 'The Seats of the Mighty', 'The Trail of the Sword'—deal with pioneer life in his native land. But he has not confined his attention to any one country. Most of the places he has lived in or visited have served him as backgrounds for one or more of his novels, or have furnished material for his books of travels. The scene of 'The Weavers', for instance, is laid in Egypt, and that of 'Cumner's Son' in the South Sea Islands. His handling of atmosphere is very skilful; he is a good story-teller; and his characters are vivid and interesting, though he does not penetrate deeply into human nature or the problems of life. Usually he gives a romantic treatment of love and war against a historical background.

But he has not devoted all of his attention by any means to literature, but has taken an active interest in politics. His residence in Canada and Australia made him a strong Imperialist, a believer in the close union of the colonies of the British Empire. He was elected to the British Parliament in 1900 as a Conservative, and served for many years. In addition he

was a member of a number of important committees. During the World War of 1914–18 he had charge of the British publicity work in America. In this capacity he wrote a large number of magazine articles, some of which will probably prove of permanent literary value. He was knighted in 1902, and in 1915 was made a baronet for his war work.

Sir Gilbert Parker's chief works are: 'Pierre and His People' (1892); 'Mrs. Falchion' (1893); 'The Trail of the Sword' (1894); 'When Valmond Came to Pontiac' (1895); 'An Adventurer of the North' (1895); 'The Seats of the Mighty' (1896); 'The Pomp of the Lavillettes' (1897); 'The Battle of the Strong' (1898): 'The Lane that Had No Turning' (1900); 'The Right of Way' (1901); 'Donovan Pasha' (1902); 'History of Old Quebec' (1903); 'A Ladder of Swords' (1904); 'The Weavers' (1907); 'Northern Lights' (1909); 'Cumner's Son' (1910); 'The Land, the People, and the State' (1910); 'The Judgment House' (1913); 'You Never Know Your Luck' (1915); 'The World in the Crucible' (1915); 'The Money Master' (1915); 'The World for Sale' (1916); 'Wild Youth, and Another' (1919).

Parkman, Francis (1823–1893). While he was still a sophomore at Harvard University, Francis Parkman, the most brilliant of American historians, resolved to write the story of the struggle between the French and English for the possession of the North American continent—or as he says—"the history of the American forest." He made his next few years a preparation for the hardships which he knew that he must undergo in collecting material among the Indians of the Northwest. Never robust, his health broke down one summer under the Spartan exercises which he practiced, and he went to Europe for a year of rest and travel. Notwithstanding this, he was graduated with his class in 1844, taking high rank.

FRANCIS PARKMAN
Brilliant American Historian

Already his vacations had been spent in exploring the woods within easy reach. In 1846 he started out with a friend for a trip over the then new Oregon trail. From St. Louis they traveled up the Missouri River to the site of Kansas City. There amid a rough crowd of all sorts and ranks of people they bought their horses, gathered their outfit, and hired their guides. After enduring many hardships they finally reached the valley of the Platte River.

They pressed on across the lonely country which stretched "for league after league as level as a lake," with "skulls and whitening bones of buffaloes scattered everywhere." They visited many Indians in their camps and were entertained by them according to their customs. In return, the two white men gave a feast at which the Indian delicacy, dog-meat, furnished the chief dish, and the very sweet tea was colored with soot, to make it seem stronger. Parkman had ample opportunity to study the Indians as they really were, and not as they had been sentimentalized by Cooper and other writers.

Parkman's trip was of inestimable value to him in carrying out his life's plan, but it undermined his delicate health. A diet exclusively of meat, exposure to storms, fatigue, and a lack of any care during a severe illness, made him an invalid for the rest of his life. The chief trouble was with his eyes. He could not bear light and was forced to spend most of his time in a darkened room. There were periods, too, when any thinking or writing made him feel as though there were an iron band around his head.

In spite of these difficulties, however, he published 'The Oregon Trail' on his return, and several years later appeared 'The Conspiracy of Pontiac'. Parts of these books he wrote with his own hand, guiding his pen in a darkened room by means of wires strung at intervals across a writing board. His wife and her sister as well as members of his own family helped him by reading aloud, gathering material, and taking his dictation. Sometimes he could write only six lines a day, and it took him two and one-half years to complete one of his books.

In 1858 Parkman's health was so bad that he had to give up work altogether. He went to Paris to consult the best physician of that time, but found no relief. No matter how much he suffered he always turned a cheerful face to the world. Few people knew what it cost him to give up writing and turn to raising roses.

After seven years he had recovered his health sufficiently to continue his work, and in 1865 he began the publication of his long series of books dealing with the history of France in the New World. His books were recognized as of the highest order, and Parkman had the satisfaction of knowing that his work was appreciated at its full value.

His place as an historian is high, for he had a combination of unusual gifts. He had the tenacity and patience of a great scholar in collecting material from all possible sources. Not only did he gain a firm basis of fact, but he knew how to treat those facts with great literary skill. He made the lonely trapper, trader, soldier, priest, and voyageur live again his life of adventure amid the wilds of a new world, whose forests, streams, prairies, and mountains are so vividly described that they too like the kings, statesmen, and explorers became part of the historic drama. 'The Oregon Trail' should be read by everybody who is interested in the development and early history of the great West.

Among the best of Parkman's books are 'The Oregon Trail' (1849); 'The Conspiracy of Pontiac' (1851); 'Montcalm and Wolfe' (1884); 'A Half-Century of Conflict' (1892).

Hilda Hankey

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